AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES

2. AMENDMENT/MODIFICAITON NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. *(If applicble)*
Amendment No. 0001	15-APR-2015		

6. ISSUED BY CODE	7. ADMINISTERED BY *(If other than Item 6)* CODE
U.S ARMY CORPS OF ENGINEERS, OMAHA DISTRICT CONTRACTING OFFICE 1616 CAPITOL AVE. OMAHA, NE 68102-4901	See Item 6

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)*	(X)	9A. AMENDMENT OF SOLICIATION NO.
	☒	W9128F-15-B-0007
		9B. DATED *(SEE ITEM 11)* 7-APR-2015
	☐	10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED *(SEE ITEM 13)*
CODE FACILITY CODE		

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☒ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a)By completing items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPIRATION DATA *(If required)*

13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

CHECK ONE	
☐	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: *(Specify authority)* THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
☐	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES *(such as changes in paying office, appropriation date, etc.*) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
☐	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
☐	D. OTHER *(Specify type of modification and authority)*

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (*Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

CONSOLIDATED DORMITORY, EGYN 08-3001
CAVALIER AIR FORCE STATION, NORTH DAKOTA

See attached documentation for content of the amendment revisions.

Date for receipt of Bids is 8 MAY 2015 at 1400 hours CST.

Government Point of Contact: Scott Hurst (402) 995-2075

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER *(Type or print)*		16A. NAME AND TITLE OF CONTRACTING OFFICER *(Type or print)*	
15B. CONTRACTOR/OFFEROR *(Signature of person authorized to sign)*	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA *(Signature of Contracting Officer)*	16C. DATE SIGNED 15-APR-2015

INSTRUCTIONS

Instructions for items other than those that are self-explanatory, are as follows:

(a) Item 1 (Contract ID Code). Insert the contract type identification code that appears in the title block of the contract being modified.

(b) Item 3 (Effective date).

(1) For a solicitation amendment, change order, or administrative change, the effective date shall be the issue date of the amendment, change order, or administrative change.

(2) For a supplemental agreement, the effective date shall be the date agreed to by the contracting parties.

(3) For a modification issued as an initial or confirming notice of termination for the convenience of the Government, the effective date and the modification number of the confirming notice shall be the same as the effective date and modification number of the initial notice.

(4) For a modification converting a termination for default to a termination for the convenience of the Government, the effective date shall be the same as the effective date of the termination for default.

(5) For a modification confirming the contacting officer's determination of the amount due in settlement of a contract termination, the effective date shall be the same as the effective date of the initial decision.

(c) Item 6 (Issued By). Insert the name and address of the issuing office. If applicable, insert the appropriate issuing office code in the code block.

(d) Item 8 (Name and Address of Contractor). For modifications to a contract or order, enter the contractor's name, address, and code as shown in the original contract or order, unless changed by this or a previous modification.

(e) Item 9, (Amendment of Solicitation No. - Dated), and 10, (Modification of Contract/Order No. - Dated). Check the appropriate box and in the corresponding blanks insert the number and date of the original solicitation, contract, or order.

(f) Item 12 (Accounting and Appropriation Data). When appropriate, indicate the impact of the modification on each affected accounting classification by inserting one of the following entries.

(1) Accounting classification
Net increase $.....

(2) Accounting classification
Net decrease $.....

NOTE: If there are changes to multiple accounting classifications that cannot be placed in block 12, insert an asterisk and the words "See continuation sheet".

(g) Item 13. Check the appropriate box to indicate the type of modification. Insert in the corresponding blank the authority under which the modification is issued. Check whether or not contractor must sign this document. (See FAR 43.103.)

(h) Item 14 (Description of Amendment/Modification).

(1) Organize amendments or modifications under the appropriate Uniform Contract Format (UCF) section headings from the applicable solicitation or contract. The UCF table of contents, however, shall not be set forth in this document

(2) Indicate the impact of the modification on the overall total contract price by inserting one of the following entries:

(i) Total contract price increased by $.....

(ii) Total contract price decreased by $.....

(iii) Total contract price unchanged.

(3) State reason for modification.

(4) When removing, reinstating, or adding funds, identify the contract items and accounting classifications.

(5) When the SF 30 is used to reflect a determination by the contracting officer of the amount due in settlement of a contract terminated for the convenience of the Government, the entry in Item 14 of the modification may be limited to --

(i) A reference to the letter determination; and

(ii) A statement of the net amount determined to be due in settlement of the contract.

(6) Include subject matter or short title of solicitation/contract where feasible.

(i) Item 16B. The contracting officer's signature is not required on solicitation amendments. The contracting offier's signature is normally affixed last on supplemental agreements.

DEPARTMENT OF THE ARMY
Omaha District, Corps of Engineers
1616 Capitol Avenue
Omaha, Nebraska 68102-4901

:NOTICE: Failure to acknowledge : :all amendments may cause rejec- : :tion of the bid. See FAR : :52.214-3 of Section 00 21 00 :	Solicitation No. W9128F 15 B 0007 Date of Issue: 7 APR 2015 New Date of Opening: 8 MAY 2015

Amendment No. 0001
15 APR 2015

SUBJECT: Amendment No. 0001 to Specifications and Drawings for Construction of Consolidated Dormitory, EGYN 08-3001, Cavalier AFS, ND.
Solicitation No. W9128F 15 B 0007

TO: Prospective Bidders and Others Concerned

1. The specifications and drawings for subject project are hereby modified as follows (revise all specification indices, attachment lists, and drawing indices accordingly).

a. Specifications. (Descriptive Changes.)

(1) Standard Form SF 1442, Page 00 10 00 -1, delete date and time of bid opening shown and substitute "8 MAY 2014" at "1400".

(2) Section 23 09 23.13 20, revise title to read "BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC".

b. Specifications (New and/or Revised and Reissued). Delete and substitute or add specification pages as noted below. The substituted pages are revised and reissued with this amendment. For convenience, on the revised specification pages, changes have been identified by underlining of added text and strikeout of deleted text.

Pages Deleted	Pages Substituted or Added
-- -- --	23 08 00.00 10
23 21 13.00 20	23 21 13.00 20
23 52 00	23 52 00
28 31 49	28 31 49
28 31 76	28 31 76
31 00 00	31 00 00

c. Drawings (Reissued). The following drawings are revised with latest revision dates of 13 & 14 APR 2015, and reissued with this amendment.

(1) Sheet ND22G-002, INDEX
(2) Sheet ND22CS101, SITE LAYOUT PLAN – AREA 101
(3) Sheet ND22CS103, SITE LAYOUT PLAN – AREA 103
(4) Sheet ND22CU101, WATER AND SEWER PLAN
(5) Sheet ND22CU201, WATER LINE PROFILES
(6) Sheet ND22S-001, GENERAL STRUCTURAL NOTES
(7) Sheet ND22S-002, FASTENING SCHEDULE AND OVER EXCAVATION
(8) Sheet ND22FA111, LEGEND AND ABBREVIATIONS

(9) Sheet ND22FA121, FIRE ALARM PLAN
(10) Sheet ND22FA601, FIRE ALARM & MASS NOTIFICATION RISER
(11) Sheet ND22FA602, FIRE ALARM & MASS NOTIFICATION RISER MATRIX
(12) Sheet ND22FX501, FIRE PROTECTION DETAILS
(13) Sheet ND22P-600, PLUMBING SCHEDULES
(14) Sheet ND22M-104, ATTIC/CLERESTORY MECHANICAL HYDRONIC PIPING PLAN
(15) Sheet ND22M-400, ENLARGED MECHANICAL ROOM PLAN
(16) Sheet ND22M-400B, SECTION VIEW 3,4
(17) Sheet ND22M-500, MECHANICAL DETAILS-1
(18) Sheet ND22M-601, BLAH DEE BLAH BLAH
(19) Sheet ND22M-700, MECHANICAL CONTROL-1
(20) Sheet ND22M-703, BOILER CONTROL
(21) Sheet ND22EL601, LIGHT FIXTURE SCHEDULE
(22) Sheet ND22EP101, MAIN FLOOR POWER PLAN
(23) Sheet ND22EP602, MECHANICAL EQUIPMENT-ELECTRICAL CONNECTIONS SCHEDULE

d. Drawings (New). The following new drawing dated 14 APR 2015 is hereby added to the contract drawings and is issued with this amendment.

(1) Sheet ND22B-101.DGN, SOIL BORING LOGS & LOCATION PLAN

2. This amendment is a part of the bidding papers and its receipt shall be acknowledged on the new Standard Form 1442. All other conditions and requirements of the specifications remain unchanged. If the bids have been mailed prior to receiving this amendment, you will notify the office where bids are opened, in the specified manner, immediately of its receipt and of any changes in your bid occasioned thereby.

a. Hand-Carried Bids shall be delivered to the U.S. Army Corps of Engineers, Omaha District, Contracting Division, 1616 Capitol Avenue, Omaha, Nebraska 68102-4901.

b. Mailed Bids shall be addressed as noted in Item 8 on Page 00 11 00-1 of Standard Form 1442.

3. Bids will be received until 2:00 p.m., local time at place of bid opening, 8 MAY 2015.

Attachments:
Spec Pages listed in 1.b. above
Dwgs. listed in 1.c. and 1.d. above

U.S. Army Engineer District, Omaha
Corps of Engineers
1616 Capitol Avenue
Omaha, Nebraska 68102-4901

15 APR 2015
jlb/2099

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COMMISSIONING OF HVAC SYSTEMS

01/08

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-- End of Section Table of Contents --

SECTION 23 08 00.00 10

COMMISSIONING OF HVAC SYSTEMS
01/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

ACG Commissioning Guideline	(2005) Commissioning Guideline

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB Commissioning Standard	(2009) Procedural Standards for Whole Building Systems Commissioning of New Construction; 3rd Edition

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1429	(1994) HVAC Systems Commissioning Manual, 1st Edition

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED NC	(2009) Leadership in Energy and Environmental Design(tm) New Construction Rating System

1.2 DEFINITIONS

In some instances, terminology differs between the Contract and the Commissioning Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results. The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding ACG, NEBB, or TABB requirements where differences exist.

SIMILAR TERMS			
Contract Term	ACG	NEBB	TABB
Commissioning Standard	ACG Commissioning Guideline	Procedural Standards for Building Systems Commissioning	SMACNA HVAC Commissioning Guidelines

SIMILAR TERMS			
Contract Term	ACG	NEBB	TABB
Commissioning Specialist	ACG Certified Commissioning Agent	NEBB Qualified Commissioning Administrator	TABB Certified Commissioning Supervisor

1.3 SYSTEM DESCRIPTION

1.3.1 General

Perform Commissioning in accordance with the requirements of the standard under which the Commissioning Firm's qualifications are approved, i.e., ACG Commissioning Guideline, NEBB Commissioning Standard, or SMACNA 1429 unless otherwise stated herein. Consider mandatory all recommendations and suggested practices contained in the Commissioning Standard. Use the Commissioning Standard for all aspects of Commissioning, including qualifications for the Commissioning Firm and Specialist and calibration of Commissioning instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the Commissioning Standard, the manufacturer's recommendations shall be adhered to. All quality assurance provisions of the Commissioning Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the Commissioning Standard, Commissioning procedures shall be developed by the Commissioning Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the Commissioning Standard used (ACG, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements shall be considered mandatory.

1.3.2 Energy

Formal LEED NC certification is not required; however, the Contractor is required to provide documentation that meets the LEED NC Energy & Atmosphere (EA) Prerequisite 1, Fundamental Commissioning. For New Construction and Major Revisions provide, also, documentation that meets EA Credit 3; Enhanced Commissioning. Provide documentation for as many LEED credits as possible to support LEED Silver certification of the project.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Commissioning Plan;G, AO

SD-03 Product Data

Pre-Functional Performance Test Checklists;G, AO
Functional Performance Tests;G, AO

SD-06 Test Reports

Commissioning Report; G, AO

SD-07 Certificates

Commissioning Firm; G, DO
Commissioning Specialist; G, DO

1.5 QUALITY ASSURANCE

1.5.1 Commissioning Firm

Submit certification of the proposed Commissioning Firm's qualifications to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. Include in the documentation the date that the Certification was initially granted and the date when the current Certification expires. The firm is either a member of ACG or certified by the NEBB or the TABB and certified in all categories and functions where measurements or performance are specified on the plans and specifications. Any lapses in Certification of the proposed Commissioning Firm or disciplinary action taken by ACG, NEBB, or TABB against the proposed Commissioning Firm shall be described in detail. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, immediately notify the Contracting Officer and submit another Commissioning Firm for approval. Any firm that has been the subject of disciplinary action by the ACG, the NEBB, or the TABB within the five years preceding Contract Award is not eligible to perform any duties related to the HVAC systems, including Commissioning. All work specified in this Section and in other related Sections to be performed by the Commissioning Firm shall be considered invalid if the Commissioning Firm loses its certification prior to Contract completion and must be performed by an approved successor. These Commissioning services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The Commissioning Firm shall be a subcontractor of the prime Contractor and shall be financially and corporately independent of all other subcontractors. The Commissioning Firm shall report to and be paid by the prime Contractor.

1.5.2 Commissioning Specialist

1.5.2.1 General

Submit certification of the proposed Commissioning Specialist's qualifications to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date when the current Certification expires. The Commissioning Specialist shall be an ACG Certified Commissioning Agent, a NEBB Qualified Commissioning Administrator, or a TABB Certified Commissioning Supervisor and shall be an employee of the approved Commissioning Firm. Any lapses in Certification of the proposed Commissioning Specialist or disciplinary action taken by ACG, NEBB, or TABB against the proposed Commissioning Specialist shall be described in detail. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Commissioning Specialist loses subject certification during this period, immediately notify the

Contracting Officer and submit another Commissioning Specialist for approval. Any individual that has been the subject of disciplinary action by the ACG, the NEBB, or the TABB within the five years preceding Contract Award is not eligible to perform any duties related to the HVAC systems, including Commissioning. All work specified in this Section and in other related Sections performed by the Commissioning Specialist shall be considered invalid if the Commissioning Specialist loses certification prior to Contract completion and must be performed by the approved successor.

1.5.2.2 Responsibilities

Perform all Commissioning work specified herein and in related sections under the direct guidance of the Commissioning Specialist. The Commissioning Specialist shall prepare, no later than 28 days after the approval of the Commissioning Specialist, the Commissioning Plan which will be a comprehensive schedule and will include all submittal requirements for procedures, notifications, reports and the Commissioning Report. After approval of the Commissioning Plan, revise the Contract NAS schedule to reflect the schedule requirements in the Commissioning Plan.

1.6 SEQUENCING AND SCHEDULING

Begin the work described in this Section only after all work required in related Sections has been successfully completed, and all test and inspection reports and operation and maintenance manuals required in these Sections have been submitted and approved. Pre-Functional Performance Test Checklists shall be performed at appropriate times during the construction phase of the Contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 COMMISSIONING TEAM AND TEST FORMS AND CHECKLISTS

Designate Contractor team members to participate in the Pre- Functional Performance Test Checklists and the Functional Performance Tests specified herein. In addition, the Government team members will include a representative of the Contracting Officer, the Design Agent's Representative, and the Using Agency's Representative. The team members shall be as follows:

Designation	Function
A	Contractor's Commissioning Specialist
M	Contractor's Mechanical Representative
E	Contractor's Electrical Representative
T	Contractor's Testing, Adjusting, and Balancing (TAB) Specialist
C	Contractor's Controls Representative

Designation	Function
D	Design Agency Representative
O	Contracting Officer's Representative
U	Using Agency's Representative

Appendices A and B shall be completed by the commissioning team. Acceptance by each commissioning team member of each Pre- Functional Performance Test Checklist item shall be indicated by initials and date unless an "X" is shown indicating that participation by that individual is not required. Acceptance by each commissioning team member of each functional performance test item shall be indicated by signature and date.

3.2 TESTS

Perform the pre-functional performance test checklists and functional performance tests in a manner that essentially duplicates the checking, testing, and inspection methods established in the related Sections. Where checking, testing, and inspection methods are not specified in other Sections, establish methods which will provide the information required. Testing and verification required by this section shall be performed during the Commissioning phase. Requirements in related Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section. Provide all materials, services, and labor required to perform the pre- functional performance tests checks and functional performance tests. A functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-Government commissioning team member of which participation is specified is not present for the test.

3.2.1 Pre-Functional Performance Test Checklists

Perform Pre-Functional Performance Test Checklists, for the items indicated in Appendix A, at least 28 days prior to the start of Pre-Functional Performance Test Checks.. Correct and re-inspect deficiencies discovered during these checks in accordance with the applicable contract requirements. Submit the schedule for the test checks at least 14 days prior to the start of Pre-Functional Performance Test Checks.

3.2.2 Functional Performance Tests

Submit test procedures at least 28 days prior to the start of Functional Performance Tests. Submit the schedule for the tests at least 14 days prior to the start of Functional Performance Tests. Perform Functional Performance Tests for the items indicated in Appendix B. Begin Functional Performance Tests only after all Pre-Functional Performance Test Checklists have been successfully completed. Tests shall prove all modes of the sequences of operation, and shall verify all other relevant contract requirements. Begin Tests with equipment or components and progress through subsystems to complete systems. Upon failure of any Functional Performance Test item, correct all deficiencies in accordance with the applicable contract requirements. The item shall then be retested until it has been completed with no errors.

3.3 COMMISSIONING REPORT

Submit the Commissioning Report, no later than 14 days after completion of Functional Performance Tests, consisting of completed Pre- Functional Performance Test Checklists and completed Functional Performance Tests organized by system and by subsystem and submitted as one package. The Commissioning Report shall also include all HVAC systems test reports, inspection reports (Preparatory, Initial and Follow-up inspections), start-up reports, TAB report, TAB verification report, Controls start-up test reports and Controls Performance Verification Test (PVT) report. The results of failed tests shall be included along with a description of the corrective action taken.

APPENDIX A

PRE-FUNCTIONAL PERFORMANCE TEST CHECKLISTS

Pre-Functional Performance Test Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: AHU-1

Checklist Item	A	M	E	T	C	O
Installation						
a. Inspection and access doors are operable and sealed.	___	___	X	___	X	___
b. Condensate drainage is unobstructed. (Visually verify drainage by pouring a cup of water into drain pan.)	___	___	X	X	X	___
c. Fan belt adjusted.	___	___	X	___	X	___
Electrical	A	M	E	T	C	O
a. Power available to unit disconnect.	___	X	___	X	X	___
b. Power available to unit control panel.	___	X	___	X	X	___
c. Proper motor rotation verified.	___	X	___	___	X	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	X	___	X	X	___
Coils	A	M	E	T	C	O
a. Refrigerant piping properly connected.	___	___	X	X	X	___
b. Hot water piping properly connected.	___	___	X	X	X	___

Pre-Functional Performance Test Checklist - Variable Volume Air Handling Unit

Controls	A	M	E	T	C	O
a. Control valves/actuators properly installed.	___	X	X	X	___	___
b. Control valves/actuators operable.	___	X	X	X	___	___
c. Dampers/actuators properly installed.	___	X	X	X	___	___
d. Dampers/actuators operable.	___	X	X	X	___	___
e. Verify proper location, installation and calibration of duct static pressure sensor.	___	X	X	X	___	___
f. Fan air volume controller operable.	___	X	X	X	___	___
g. Air handler controls system operational.	___	X	X	X	___	___

Testing, Adjusting, and Balancing (TAB)	A	M	E	T	C	O
a. Construction filters removed and replaced.	___	___	X	___	___	___
b. TAB report approved.	___	X	X	___	X	___

Pre-Functional Performance Test Checklist - VAV Terminal

For VAV Terminal: _____

Checklist Item	A	M	E	T	C	O
Installation						
a. Reheat coil connected to hot water pipe.	___	___	X	___	X	___
Controls	**A**	**M**	**E**	**T**	**C**	**O**
a. Reheat VAV terminal controls set.	___	X	X	X	___	___
b. Reheat terminal/coil controls verified.	___	X	X	X	___	___
Testing, Adjusting, and Balancing (TAB)	**A**	**M**	**E**	**T**	**C**	**O**
a. TAB report approved.	___	___	X	___	X	___

Pre-Functional Performance Test Checklist - DX Air Cooled Condensing Unit

For Condensing Unit: CU-1

Checklist Item	A	M	E	T	C	O
Installation						
a. Check condenser fans for proper rotation.	___	___	X	___	X	___
Electrical	**A**	**M**	**E**	**T**	**C**	**O**
a. Power available to unit disconnect.	___	X	___	X	X	___
b. Power available to unit control panel.	___	X	___	X	___	___
c. Verify that power disconnect is located within sight of the unit it controls	___	X	___	X	___	___
Controls	**A**	**M**	**E**	**T**	**C**	**O**
a. Unit safety/protection devices tested.	___	___	X	X	___	___
b. Control system and interlocks installed.	___	___	X	X	___	___
c. Control system and interlocks operational.	___	___	X	X	___	___

Pre-Functional Performance Test Checklist - Pumps

For Pump: HWP-1 / HWP-2

Checklist Item	A	M	E	T	C	O
Installation						
a. Piping system installed.	___	___	X	X	X	___
Electrical	**A**	**M**	**E**	**T**	**C**	**O**
a. Power available to pump disconnect.	___	X	___	X	X	___
b. Pump rotation verified.	___	X	___	X	X	___
c. Control system interlocks functional.	___	X	___	X	___	___
Testing, Adjusting, and Balancing (TAB)	**A**	**M**	**E**	**T**	**C**	**O**
a. Pressure/temperature gauges installed.	___	___	X	___	X	___
b. TAB Report approved.	___	___	X	___	X	___

Pre-Functional Performance Test Checklist - Hot Water Boiler

For Boiler: B-1 / B-2

Checklist Item						
Installation	**A**	**M**	**E**	**T**	**C**	**O**
a. Boiler hot water piping installed.			X			
b. Boiler gas piping installed.			X	X	X	
Startup	**A**	**M**	**E**	**T**	**C**	**O**
a. Boiler safety/protection devices, including high temperature burner shut-off, low water cutoff, flame failure, pre- and post-purge, have been tested.				X		
b. Verify that PRV rating conforms to boiler rating.				X		
c. Boiler water treatment system functional.			X	X		
d. Boiler startup and checkout complete.			X	X		
e. Combustion efficiency demonstrated.			X		X	
Electrical	**A**	**M**	**E**	**T**	**C**	**O**
a. Verify that power disconnect is located within sight of the unit served.		X		X		
Controls	**A**	**M**	**E**	**T**	**C**	**O**
a. Hot water pump interlock installed and tested.				X		
b. Hot water proof-of-flow switch installed and tested			X	X		
c. Hot water heating controls operational.			X	X		
Testing, Adjusting, and Balancing (TAB)	**A**	**M**	**E**	**T**	**C**	**O**
a. TAB report approved.			X		X	

Pre-Functional Performance Test Checklist - Unit Heater

For Unit Heater: _____

Checklist Item						
Installation	A	M	E	T	C	O
a. Hot water piping properly connected.	___	___	X	___	___	___
Electrical	**A**	**M**	**E**	**T**	**C**	**O**
a. Power available to unit disconnect.	___	___	___	X	___	___
b. Proper motor rotation verified.	___	___	___	X	X	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___
d. Power available to electric heating coil.	___	___	___	X	___	___
Controls	**A**	**M**	**E**	**T**	**C**	**O**
a. Control valves properly installed.	___	___	X	___	___	___
b. Control valves operable.	___	___	X	X	___	___
c. Verify proper location and installation of thermostat.	___	___	X	___	___	___
Testing, Adjusting, and Balancing (TAB)	**A**	**M**	**E**	**T**	**C**	**O**
a. TAB Report approved.	___	___	X	___	X	___

Pre-Functional Performance Test Checklist - Exhaust Fan

For Exhaust Fan: _____

Checklist Item						
Installation	A	M	E	T	C	O
a. Fan belt adjusted.			X		X	
Electrical	A	M	E	T	C	O
a. Power available to fan disconnect.				X		
b. Proper motor rotation verified.					X	
c. Verify that power disconnect is located within sight of the unit it controls.				X		
Controls	A	M	E	T	C	O
a. Control interlocks properly installed.				X		
b. Control interlocks operable.				X		
c. Dampers/actuators properly installed.			X			
d. Dampers/actuators operable.			X			
e. Verify proper location and installation of thermostat.			X			
Testing, Adjusting, and Balancing (TAB)	A	M	E	T	C	O
a. TAB Report approved.			X		X	

Pre-Functional Performance Test Checklist - HVAC System Controls

For HVAC System: _____

Checklist Item						
Installation	A	M	E	T	C	O
a. Layout of control panel matches drawings.	___	___	X	X	___	___
b. Framed instructions mounted in or near control panel.	___	___	X	X	___	___
c. Components properly labeled (on inside and outside of panel).	___	___	X	X	___	___
d. Control components piped and/or wired to each labeled terminal strip.	___	___	X	X	___	___
e. EMCS connection made to each labeled terminal strip as shown.	___	___	X	X	___	___
f. Control wiring and tubing labeled at all terminations, splices, and junctions.	___	___	X	X	___	___
Main Power and Control Air						
a. 120 volt AC power available to panel.	___	___	___	X	___	___
b. 20 psig compressed air available to panel.	___	___	X	X	___	___
Testing, Adjusting, and Balancing (TAB)	A	M	E	T	C	O
a. TAB Report submitted.	___	___	X	___	X	___

- End of Appendix A -

APPENDIX B

FUNCTIONAL PERFORMANCE TESTS CHECKLISTS

Functional Performance Test - Pump _____

NOTE: Prior to performing this test, for closed loop systems ensure that the system is pressurized and the make-up water system is operational, or for open loop systems ensure that the sumps are filled to the proper level.

1. Activate pump start using control system commands.

a. Verify correct operation in:

HAND_____ OFF_____ AUTO_____

b. Verify pressure drop across strainer:

Strainer inlet pressure _____ psig

Strainer outlet pressure _____ psig

c. Verify pump inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report and pump design conditions.

	DESIGN	TAB	ACTUAL
Pump inlet pressure psig	_____	_____	_____
Pump outlet pressure psig	_____	_____	_____

d. Operate pump at shutoff and at 100 percent of designed flow when all components are in full flow. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure psig	_____	_____
Pump outlet pressure psig	_____	_____
Pump flow rate gpm	_____	_____

	SETPOINT
Differential Pressure Transmitter	_____

Functional Performance Test (cont) - Pump _____

e. For variable speed pumps, operate pump at shutoff (shutoff to be done in manual on variable speed drive at the minimum rpm that the system is being controlled at) and at minimum flow or when all components are in full by-pass. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure psig	_____	_____
Pump outlet pressure psig	_____	_____
Pump flow rate gpm	_____	_____

	SETPOINT
Differential Pressure Transmitter	_____

2. Measure motor amperage each phase and voltage phase to phase and phase to ground for both the full flow and the minimum flow conditions. Compare amperage to nameplate FLA.

a. Full flow:

Nameplate FLA _____

Amperage	Phase 1 _____		Phase 2_____		Phase 3_____
Voltage	Ph1-Ph2 _____		Ph1-Ph3_____		Ph2-Ph3_____
Voltage	Ph1-gnd _____		Ph2-gnd_____		Ph3-gnd_____

b. Minimum flow:

Amperage	Phase 1 _____		Phase 2_____		Phase 3_____
Voltage	Ph1-Ph2 _____		Ph1-Ph3_____		Ph2-Ph3_____
Voltage	Ph1-gnd _____		Ph2-gnd_____		Ph3-gnd_____

3. Note unusual vibration, noise, etc.

_____

_____

Functional Performance Test (cont) - Pump _____

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Specialist	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's TAB Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____
Design Agency Representative	_____
Using Agency's Representative	_____

Functional Performance Test Checklist - VAV Terminals

The Contracting officer will select VAV terminals to be spot-checked during the functional performance test. The number of terminals selected shall not exceed 10 percent.

1. Functional Performance Test: Contractor shall demonstrate operation of selected VAV boxes in accordance with specifications including the following:

a. Cooling with reheat VAV boxes:

(1) Verify VAV box response to room temperature set point adjustment. Turn thermostat to 5 degrees F above ambient and measure maximum airflow. Turn thermostat to 5 degrees F below ambient and measure minimum airflow.

	Setting	Measured	Design	
Maximum flow	_____	_____	_____	cfm
Minimum flow	_____	_____	_____	cfm

(2) Verify reheat coil operation range (full closed to full open) by turning room thermostat 5 degrees F above ambient _____.

With heating water system and boiler in operation providing design supply hot water temperature record the following:

Design HW supply temperature_____ deg F
Actual HW supply temperature_____ deg F
AHU supply air temperature_____ deg F
VAV supply air temperature_____ deg F
Calculate coil capacity and compare to design:
Design _____ BTU/hr Actual _____BTU/hr

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Specialist	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's TAB Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____
Design Agency Representative	_____
Using Agency's Representative	_____

Functional Performance Test Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: AHU-1

1. Functional Performance Test: Contractor shall verify operation of air handling unit in accordance with specification including the following:

a. Ensure that a slight negative pressure exists on inboard side of the outside air dampers throughout the operation of the dampers. Modulate OA, RA, and EA dampers from fully open to fully closed positions_____.

b. The following shall be verified supply and return fans operating mode is initiated:

(1) All dampers in normal position prior to fan start_____.

(2) All valves in normal position prior to fan start_____.

(3) System safeties allow start if safety conditions are met.____

(4) VAV fan controller shall "soft-start" fan. _____

(5) Modulate all VAV boxes to minimum air flow and verify that the static pressure does not exceed the high static pressure shutdown setpoint_____.

(6) Return all VAV boxes to auto _____.

c. Occupied mode of operation - economizer de-energized.

(1) Outside air damper at minimum position. _____

(2) Return air damper open. _____

(3) Relief air damper at correct position. _____

(4) Chilled water control valve modulating to maintain leaving air temperature set point. Setpoint _____deg F Actual _____deg F

(5) Fan VAV controller receiving signal from duct static pressure sensor and modulating fan to maintain supply duct static pressure set point.
Setpoint _____inches-wg Actual _____inches-wg

d. Occupied mode of operation - economizer energized.

(1) Outside air damper modulated to maintain mixed air temperature set point. Setpoint _____deg F, Actual _____deg F, Outside air damper position _____ percent.

(2) Relief air damper modulates with outside air damper according to sequence of operation. Relief air damper position_____ percent.

(3) Chilled water control valve modulating to maintain leaving air temperature set point. Setpoint _____deg F Actual _____deg F

(4) Hot water control valve modulating to maintain leaving air

temperature set point. Setpoint _____deg F Actual _____deg F

Functional Performance Test Checklist (cont) - Variable Volume Air Handling Unit

(5) Fan VAV controller receives signal from duct static pressure sensor and modulates fan to maintain supply duct static pressure set point. Setpoint inches-wg_____ Actual inches-wg_____

e. Unoccupied mode of operation

(1) Observe fan starts when space temperature calls for heating and/or cooling. _____ Note: This does not apply to series boxes.
(2) All dampers in normal position. _____
(3) Verify space temperature is maintained as specified in sequence of operation. _____

f. The following shall be verified when the supply and return fans off mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) Fan de-energizes. _____

g. Verify the chilled water coil control valve operation by setting all VAV's to maximum and minimum cooling.

Max Cooling

Supply air temp. _____ deg F Verify cooling valve operation_____.

Min cooling

Supply air temp. _____ deg F Verify cooling valve operation_____.

h. Verify safety shut down initiated by low temperature protection thermostat. _____

i. Verify occupancy schedule is programmed into time clock/UMCS_____.

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Specialist _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's TAB Representative _____

Contractor's Controls Representative _____

Design Agency Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Functional Performance Test Checklist - Air Cooled Condensing Unit

For Condensing Unit: CU-1

1. Functional Performance Test: Contractor shall demonstrate operation of refrigeration system in accordance with specifications including the following: Start building air handler to provide load for condensing unit. Activate controls system start sequence as follows.

a. Start air handling unit. Verify control system energizes condensing unit start sequence. _____

b. Verify and record data in 2 and 3 below.

c. Shut off air handling equipment to verify condensing unit de-energizes. _____

d. Restart air handling equipment one minute after condensing unit shut down. Verify condensing unit restart sequence. _____

2. Verify condensing unit amperage each phase and voltage phase to phase and phase to ground.

Motor Full-Load Amps _____

Amperage Phase 1 _____ Phase 2_____ Phase 3_____

Voltage Ph1-Ph2 _____ Ph1-Ph3_____ Ph2-Ph3_____

Voltage Ph1-gnd _____ Ph2-gnd_____ Ph3-gnd_____

3. Record the following information:

Ambient dry bulb temperature	_____	degrees F
Suction pressure	_____	psig
Discharge pressure	_____	psig

4. Unusual vibration, noise, etc.

_____

_____

5. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Specialist _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's TAB Representative _____

Contractor's Controls Representative _____

Design Agency Representative _____

Contracting Officer's Representative _____

Using Agency's Representative _____

Functional Performance Test Checklist - Hot Water Boiler

For Boiler: B-1 / B-2

1. Functional Performance Test: Contractor shall demonstrate operation of hot water system in accordance with specifications including the following: Start building heating equipment to provide load for boiler. Activate controls system boiler start sequence as follows.

a. Start hot water pump and establish hot water flow. Verify boiler hot water proof-of-flow switch operation. _____
Record outdoor air temperature. _____

b. Verify control system energizes boiler start sequence. _____

c. Verify boiler senses hot water temperature below set point and control system activates boiler start. Setpoint_____deg F

2. Verify boiler inlet/outlet pressure reading, compare to Test and Balance (TAB) Report, boiler design conditions, and boiler manufacturer's performance data.

	DESIGN	SYSTEM TEST	ACTUAL
Boiler inlet water temperature deg F	_____	_____	_____
Boiler outlet water temperature deg F	_____	_____	_____
Boiler outlet pressure psig	_____	_____	_____
Boiler flow rate gpm	_____	_____	_____
Flue-gas temperature at boiler outlet deg F		_____	_____
Percent carbon dioxide in flue-gas		_____	_____
Draft at boiler flue-gas exit inches-wg		_____	_____
Stack emission pollutants concentration	_____	_____	_____
Fuel type	_____	_____	_____
Combustion efficiency	_____	_____	_____

3. Record the following information:

Ambient dry bulb temperature to determine reset schedule_____degrees F
Building Entering hot water temperature _____degrees F
Building Leaving hot water temperature _____ degrees F

4. Verify temperatures in item 3 are in accordance with the reset schedule. _____

5. Verify proper operation of boiler safeties. _____
   a. Low water_____
   b. Water flow____
   c. Flame failure____
   d. Pilot failure____
   e. Pre and Post Purge failure____
   f. Pressure relief___
   g. High temperature____

6. Shut off building heating equipment to remove load on hot water system. Verify boiler shutdown sequence is initiated and accomplished after load is removed. _____

Functional Performance Test Checklist (cont) - Hot Water Boiler

7. Unusual vibration, noise, etc.

_____

_____

8. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Specialist	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's TAB Representative	_____
Contractor's Controls Representative	_____
Design Agency Representative	_____
Contracting Officer's Representative	_____
Using Agency's Representative	_____

Functional Performance Test Checklist - Unit Heaters

The Contracting Officer will select unit heaters to be spot-checked during the functional performance test. The number of terminals shall not exceed 10 percent. Hot water systems (for hot water unit heaters) must be in operation and supplying design hot water supply temperature water.

1. Functional Performance Test: Contractor shall demonstrate operation of selected unit heaters:

a. Verify unit heater response to room temperature set point adjustment._____

b. Check heating mode inlet air temperature. _____ deg F

c. Check heating mode outlet air temperature. _____ deg F

d. Record manufacturer's submitted fan capacity _____cfm

e. Calculate unit heater capacity using manufacturer's fan capacity and recorded temperatures and compare to design.

f. Calculated_____BTU/hr Design_____BTU/hr

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Specialist	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's TAB Representative	_____
Contractor's Controls Representative	_____
Design Agency Representative	_____
Contracting Officer's Representative	_____
Using Agency's Representative	_____

Functional Performance Test Checklist - HVAC Controls

For HVAC System:

The Contracting Officer will select HVAC control systems to undergo functional performance testing. The number of systems shall not exceed 10 percent. Perform this test simultaneously with FPT for AHU or other controlled equipment.

1. Functional Performance Test: Contractor shall verify operation of HVAC controls by performing the Performance Verification Test (PVT) test for that system. Contractor to provide blank PVT test procedures previously done by the controls Contractor.

2. Verify interlock with UMCS system_____.

3. Verify all required I/O points function from the UMCS system_____.

4. Certification: We the undersigned have witnessed the Performance Verification Test and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Specialist	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's TAB Representative	_____
Contractor's Controls Representative	_____
Design Agency Representative	_____
Contractor's Officer's Representative	_____
Using Agency's Representative	_____

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SECTION 23 21 13.00 20

LOW TEMPERATURE WATER (LTW) HEATING SYSTEM

04/06

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LOW TEMPERATURE WATER (LTW) HEATING SYSTEM
04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	(2009) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)

ASME INTERNATIONAL (ASME)

ASME B1.1	(2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.20.1	(2013) Pipe Threads, General Purpose (Inch)
ASME B16.1	(2010) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.11	(2011) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(2012) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.24	(2011) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2013) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings:

NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B16.9 (2012) Standard for Factory-Made Wrought Steel Buttwelding Fittings

ASME B18.2.2 (2010) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B31.9 (2014) Building Services Piping

ASME B40.100 (2013) Pressure Gauges and Gauge Attachments

ASME BPVC SEC VIII D1 (2010) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A194/A194M (2014) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both

ASTM A307 (2012) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM A53/A53M (2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM B32 (2008) Standard Specification for Solder Metal

ASTM B88 (2009) Standard Specification for Seamless Copper Water Tube

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015 (2010) Copper Tube Handbook

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-110 (2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

MSS SP-58 (2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

MSS SP-69 (2003; Notice 2012) Pipe Hangers and Supports - Selection and Application (ANSI

	Approved American National Standard)
MSS SP-70	(2011) Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-80	(2013) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(2011) Gray Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2011) Enclosures
NEMA MG 1	(2011; Errata 2012) Motors and Generators

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1689	(Rev B) Tape, Pressure-Sensitive Adhesive, (Plastic Film)
CID A-A-50560	(Basic) Pumps, Centrifugal, Water Circulating, Electric-Motor-Driven
CID A-A-59617	(Basic) Unions, Brass or Bronze, Threaded Pipe Connections and Solder-Joint Tube Connections
FS WW-S-2739	(Basic; Notice 1) Strainers, Sediment: Pipeline, Water, Air, Gas, Oil, or Steam

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.144	Safety Color Code for Marking Physical Hazards
29 CFR 1910.219	Mechanical Power Transmission Apparatus

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS applies to this section with additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

Except as specified otherwise, equipment and piping components shall be suitable for use in low temperature water heating system. Except as modified herein, the pressure temperature limitations shall be as specified in the referenced standards and specifications. Pressures in this specification are pressures in pounds per square inch above atmospheric pressure, and temperatures are in degrees Fahrenheit (F).

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29SUSTAINABILITY REQUIREMENTS. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Hot water heating system

SD-03 Product Data

Pumps

Include pump speed and characteristic curve for performance of impeller selected for each pump. Curves shall indicate capacity vs head, efficiency, and brake power for full range, from shut-off to free delivery.

Expansion tanks

Flow measuring equipment

External air separation tanks

SD-06 Test Reports

Hydrostatic test of piping system

Auxiliary equipment and accessory tests

Submit test reports in accordance with the paragraph entitled "Field Quality Control."

SD-10 Operation and Maintenance Data

Pumps, Data Package 3; G, AO

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Submit a list of qualified service organizations which includes addresses and qualifications.

1.5 QUALITY ASSURANCE

1.5.1 Standard Commercial Product for Terminal Units

Terminal units provided shall comply with features called out in this specification and shall be the manufacturer's standard commercial product. Additional or better features which are not prohibited by this specification but which are a part of the manufacturer's standard commercial product, shall be included in the terminal units being furnished. A standard commercial product is a product which has been sold or is currently being offered for sale, on the commercial market through advertisements or manufacturer's catalogs, or brochures. Provide Institute

of Boiler and Radiator Manufacturer (IBR) or Steel Boiler Institute (SBI) rating for required capacity.

1.5.2 Brazing and Soldering

1.5.2.1 Brazing Procedure

ASME B31.9. Brazing procedure for joints shall be as outlined in CDA A4015.

1.5.2.2 Soldering, Soldering Preparation, and Procedures for Joints

ASME B31.9 and as outlined in CDA A4015.

1.6 SAFETY STANDARDS

1.6.1 Guards

Couplings, motor shafts, gears and other moving parts shall be guarded, in accordance with OSHA 29 CFR 1910.219. Guards shall be cast iron or expanded metal. Guard parts shall be rigid and removable without disassembling the guarded unit.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

2.1.1 Hot Water Heating Pipe (Supply and Return)

ASTM A53/A53M electric resistance welded or seamless Schedule 40 steel pipe or ASTM B88 Type L hard drawn Copper tubing.

2.1.2 Fittings

Provide fittings compatible with the pipe being provided and shall conform to the following requirements.

2.1.2.1 Steel or Malleable Iron Pipe

Sizes 1/8 to 2 inches. ASME B16.11 steel socket welding or screwed type or ASME B16.3 for screwed type malleable iron fittings.

2.1.2.2 Steel, Cast Iron, or Bronze

Sizes 2 1/2 inches and above. Steel fitting butt welding type ASME B16.9 or ASME B16.5 flanged type. Cast iron fittings flanged type ASME B16.1. Bronze fittings up to 8 inch size flanged type ASME B16.24.

2.1.2.3 Fittings for Copper Tubing

ASME B16.18 cast bronze solder joint type or ASME B16.22wrought copper solder joint type. Fittings may be flared or compression joint type.

2.1.3 Unions

2.1.3.1 Steel Pipe

Provide ASME B16.39, malleable iron unions, threaded connections.

2.1.3.2 Copper Tubing

Provide CID A-A-59617, bronze unions, solder joint end.

2.1.3.3 Dielectric Union

Provide insulated union with galvanized steel female pipe-threaded end and a copper solder joint end conforming with ASME B16.39, Class 1, dimensional, strength and pressure requirements. Union shall have a water-impervious insulation barrier capable of limiting galvanic current to one percent of the short-circuit current in a corresponding bimetallic joint. When dry, insulation barrier shall be able to withstand a 600-volt breakdown test.

2.1.4 Drains and Overflows

2.1.4.1 Steel Pipe

ASTM A53/A53M, Schedule 40, Malleable iron or forged steel fittings, screwed or welded joints.

2.1.4.2 Copper Tubing

ASTM B88, Type L hard drawn, cast brass or wrought copper fittings, Grade Sb5 solder joints.

2.1.5 Valves

Valves shall have rising stems and shall open when turned counterclockwise.

2.1.5.1 Gate Valves

a. Bronze Gate Valves: MSS SP-80, 2 inches and smaller, wedge disc, inside screw type not less than Class 150. Use solder joint ends with copper tubing.

c. Cast Iron Gate Valves: MSS SP-70, 2 1/2 inches and larger, open stem and yoke type with bronze trim.

2.1.5.2 Globe and Angle Valves

a. Bronze Globe and Angle Valves: MSS SP-80, 2 inches and smaller, Class 200, except use Class 150 with solder ends for copper tubing. Valves shall have renewable seat and discs except solder end valves which shall have integral seats.

b. Steel Globe and Angle Valves: ASME B16.34, provide with heat and corrosion-resistant trim.

c. Cast Iron Globe and Angle Valves: MSS SP-85, 2 1/2 inches and larger, with bronze trim, tapped drains and brass plug.

2.1.5.3 Check Valves

a. Bronze Check Valves: MSS SP-80, 2 inches and smaller, regrinding swing check type, Class 200.

b. Cast Iron Check Valves: ASME B16.34, 2 1/2 inches and larger, bronze trim, non-slam, eccentric disc type for centrifugal pump discharge

service.

2.1.5.4 Water Pressure-Reducing Valves

ASSE 1003.

2.1.5.5 Ball Valves

Threaded and solder joint ends shall conform to MSS SP-110.

2.1.5.6 Flow Control Balancing Valves

Copper alloy or cast iron body, copper alloy or stainless internal working parts, and integral pointer that indicates the degree of valve opening. Valves shall be suitable for 125 psig at 190 degrees F hot water. Valve shall function as a service valve when in fully closed position. Valve body shall have factory-installed tappings for differential pressure meter connections for verification of pressure differential across valve orifice. Meter connections shall have positive check valves or shutoff valves. Each valve shall have metal tag showing the gallons per minute flow for each differential pressure reading.

2.1.5.7 Relief Valves

Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.1.5.8 Valve Operating Mechanisms

Provide power operators where indicated and as specified.

a. Power Operators: Shall be electronic as specified in Section 23 09 23 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

b. Extension Stem: Corrosion resisting steel designed for rising and non-rising stems. Provide in length required to connect the valve stem and the operating mechanism and of sufficient cross section to transfer the torque required to operate the valve.

2.1.5.9 Balancing Valves

Balancing valves shall be calibrated bronze body balancing valves with integral ball valve and venturi or valve orifice and valve body pressure taps for flow measurement based on differential pressure readings. Valve pressure taps and meter connections shall have seals and built-in check valves with threaded connections for a portable meter. Meter shall be provided by the same manufacturer and be capable of reading system pressures and shall meet the requirements of the paragraph entitled "Flow Measuring Equipment." Valves shall have internal seals to prevent leakage around rotating element and be suitable for full shut-off rated pressure. Valves shall have an operator with integral pointer and memory stop. Balancing valves shall be selected for the required flows as indicated on the plans.

2.1.6 End Connections

2.1.6.1 Flexible Connectors

Provide flexible pipe connectors on piping connected to equipment.

Flexible section shall consist of rubber, tetrafluoroethylene resin, corrosion-resistant steel, bronze, monel, or galvanized steel. Material provided and configuration shall be suitable for pressure,temperature, and circulating medium. Flexible section shall have threaded,soldering orflanged ends and shall be suitable for service intended. Flexible section may be reinforced with metal retaining rings, with built-in braided wire reinforcement and restriction bolts or with wire braid cover suitable for service intended.

2.1.6.2 Steel Piping

Screwed or socket welded for 2 inches and smaller and flanged or butt welded for 2 1/2 inches and larger.

a. Screwed Joints With Taper Threads: ASME B1.20.1.

b. Flanged Joints: Bolting and gaskets shall be as follows:

(1) Bolting: Bolt and stud material ASTM A307, Grade B, and nut material ASTM A194/A194M, Grade 2. Bolt, stud, and nut dimensions ASME B18.2.2 threads ASME B1.1coarse type with Class 2A fit for bolts and studs, and Class 2B fit for nuts. Bolts or bolt studs shall extend completely through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Carbon steel bolts shall have American Standard regular square or heavy hexagon heads and shall have American Standard heavy semifinished hexagonal nuts conforming to ASME B18.2.2.

(2) Gaskets: ASME B16.21, Nonasbestos compressed material 1/16 inch thickness full face or self-centering flat ring type and suitable for pressure and temperature of the piping system.

c. Butt Weld Joints: ASME B31.9. Backing rings shall conform to ASME B31.9. Ferrous rings shall not exceed 0.05 percent sulfur; for alloy pipe, backing rings shall be of material compatible with the chemical composition of the parts to be welded and preferably of the same composition. Provide continuous machined or split band backing rings.

d. Socket Weld Joints: ASME B31.9.

2.1.6.3 Joints for Copper Tubing

a. Solder conforming to ASTM B32 alloy grade Sb5 or Sn96. Solder and flux shall be lead free (less than 0.2 percent of lead).

b. Copper Tube Extracted Joint: An extracted mechanical tee joint may be made in copper tube. Make joint with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, provide dimpled depth stops. Notch the branch tube for proper penetration into fitting to assure a free flow joint. Braze extracted joints using a copper phosphorous classification brazing filler metal. Soldered joints shall not be permitted.

2.1.7 Instrumentation

2.1.7.1 Pressure and Vacuum Gauges

Provide ASME B40.100 with restrictor.

2.1.7.2 Indicating Thermometers

Thermometers shall be dial type with an adjustable angle suitable for the service. Provide thermowell sized for each thermometer in accordance with the thermowell specification. Fluid-filled thermometers (mercury is not acceptable) shall have a nominal scale diameter of 5 inches. Construction shall be stainless-steel case with molded glass cover, stainless-steel stem and bulb. Stem shall be straight, length as required to fit well. Bimetal thermometers shall have a scale diameter of 3 1/2 inches. Case shall be hermetic. Case and stem shall be constructed of stainless steel. Bimetal stem shall be straight and of a length as required to fit the well.

2.1.7.3 Pressure/Temperature Test Ports

Pressure/Temperature Test Ports shall have brass body and EPDM and/or Neoprene valve seals. Ports shall be rated for service between 35 and 275 degrees F and up to 500 psig. Ports shall be provided in lengths appropriate for the insulation thickness specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS and installed to allow a minimum of 12 inches of access for probe insertion. Provide with screw-on cap attached with a strap or chain to prevent loss when removed. Ports shall be 1/4 inch NPT and accept 1/8 inch diameter probes.

2.1.8 Miscellaneous Pipeline Components

2.1.8.1 Air Vent

Provide float type air vent in hydronic systems. Vent shall be constructed of brass or semi-steel body, copper float, and stainless steel valve and valve seat. Design air vent to suit system operating temperature and pressure. Provide isolating valve to permit service without draining the system. Pipe discharge of vent to a drain.

2.1.8.2 Strainers

Strainers for classes 125 and 250 piping in IPS 1/2 to 8 inches, inclusive, FS WW-S-2739 and locate as indicated.

2.1.8.3 Hangers and Supports

Design and fabrication of pipe hangers, supports, and welding attachments shall conform to MSS SP-58 and ASME B31.9. Hanger types and supports for bare and covered pipe shall conform to MSS SP-69 for the temperature range.

2.1.8.4 Pipe Sleeves

Sleeves in partitions shall be zinc-coated sheet steel having a nominal weight of not less than 0.906 pound per square foot.

2.1.8.5 Escutcheon Plates

Provide one piece or split hinge metal plates for piping passing through floors, walls, and ceilings in exposed spaces. Provide polished stainless

steel plates or chromium-plated finish on copper alloy plates in finished spaces and paint finish on metal plates in unfinished spaces.

2.2 CENTRAL MECHANICAL EQUIPMENT

2.2.1 Boilers

Provide as specified in Section 23 52 00 HEATING BOILERS.

2.3 PIPING SYSTEM EQUIPMENT

2.3.1 Pumps

Provide hot water circulating pumps, CID A-A-50560, Service A. Pump casing and flange shall be made of close-grained cast iron. Shaft shall be carbon or alloy steel with lubricated bearings and impeller shall be bronze. Select pumps so that the operating point on selected impeller-curve will lie at or to the left of shutoff side of, and not more than 5 percent below, point of maximum efficiency for impeller. Provide motors of open dripproof type conforming to NEMA MG 1 and suitable for electrical characteristic as indicated. Motor starters for constant speed pumps shall conform to NEMA ICS 2 across the line type with NEMA ICS 6general purpose enclosure. Motor starters for variable speed motors shall comply with the requirements of Section 26 29 23 VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS. The type of starter provided shall be as indicated on the drawings.

2.3.2 Expansion Tanks

Provide bladder type expansion tank constructed of welded steel, constructed and tested hydrostatically in accordance with ASME BPVC SEC VIII D1. Tank shall be equipped with all necessary fittings. The tank and fittings shall be pressure rated at least equal to the test pressure of the total system. Zinc coat the tank inside and out after fabrication by the hot dip process ASTM A123/A123M.

2.3.3 External Air Separation Tanks

Provide tank constructed of steel, designed for not less than 75 psig, and constructed and tested in accordance with the requirements of ASME BPVC SEC VIII D1. Provide tangential inlet and outlet connections, flanged for sizes 2 1/2 inches and larger. Each unit shall have an internal design suitable for creating the required vortex and subsequent air separation. Provide with automatic air release device and galvanized steel strainer. Provide a blow down connection with a gate valve and piped to nearest floor drain.

2.3.4 Chemical Feed Tank

A 5 gallon chemical feed tank shall be provided as part of the hot water piping system as indicated in the drawings. The feeder shall be furnished with an air vent, drain valve, chemical fill funnel, valves, fittings, and piping.

2.4 TERMINAL UNITS

2.4.1 Unit Heaters

Provide hot water unit heaters as specified below, and shall have a heating capacity not in excess of 125 percent of the capacity indicated.

2.4.1.1 Propeller Fan Heaters

Heaters shall be designed for suspension and arranged for horizontal or vertical discharge of air as indicated on the drawings. Casings shall be not less than 20 gauge black steel and finished with lacquer or enamel. Suitable stationary deflectors shall be provided to assure proper air and heat penetration capacity at floor level based on established design temperature. Suspension from heating pipes will not be permitted. Fans for vertical discharge type heaters shall operate at speeds not in excess of 1,200 rpm, except that units with 80,000 Btu output capacity or less may operate at speeds up to 1,800 rpm. Horizontal discharge type unit heaters shall have discharge or face velocities not in excess of the following:

Unit Capacity, cfm	Face Velocity, fpm
Up to 1000	800
1,001 to 3,000	900
3001 and over	1,000

2.4.1.2 Heating Elements

Heating coils shall be of suitable nonferrous alloy with threaded or brazed fittings at each end for connecting to external piping. The heating elements shall be free to expand or contract without developing leaks and shall be properly pitched for drainage. The elements shall be tested under a hydrostatic pressure of 200 psig and a certified report of the test shall be submitted to the Contracting Officer. Coils shall be suitable for use with water up to 200 degrees F.

2.4.1.3 Motors

Motors shall be provided with NEMA 250 general purpose enclosure. Motors and motor controls shall otherwise be as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.4.1.4 Controls

~~Controls shall be provided as specified in Section 23 09 23 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER LOCAL BUILDING SYSTEMS.~~Provide unit heaters with manufacturers standard unit mounted, adjustable thermostat. Thermostat shall be line or low voltage. For low voltage thermostats provide transformer as required.

2.5 ELECTRICAL EQUIPMENT

Provide complete with motors, motor starters, thermal overload protection, and controls. Equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.6 CONTROLS

Provide controls as specified in Section 23 09 23 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

2.7 INSULATION

Provide shop and field applied insulation as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.8 ASBESTOS PROHIBITION

Asbestos and asbestos containing products are prohibited.

PART 3 EXECUTION

3.1 PREPARATION

Provide storage for equipment and material at the project site. All parts shall be readily accessible for inspection, repair, and renewal. Protect material and equipment from the weather.

3.2 INSTALLATION

Piping fabrication, assembly, welding, soldering, and brazing shall conform to ASME B31.9. Piping shall follow the general arrangement shown. Route piping and equipment within buildings out of the way of lighting fixtures and doors, windows, and other openings. Run overhead piping in buildings in inconspicuous positions. Provide adequate clearances from walls, ceilings, and floors to permit welding of joints and application of insulation. Make provision for expansion and contraction of pipe lines. Make changes in size of water lines with reducing fittings. Do not bury, conceal, or insulate until piping has been inspected, tested, and approved. Do not run piping concealed in walls, partitions, underground, or under the floor except as otherwise indicated. Where pipe passes through building structure, locate pipe joints and expansion joints where they may be inspected. Furnish gaskets, packing, and thread compounds suitable for the service. Provide long radius ells where possible to reduce pressure drops. Pipe bends in lieu of welding fittings may be used where space permits. Pipe bends shall have a uniform radius of at least five times the pipe diameter and shall be free from appreciable flattening, wrinkling, or thinning of the pipe. Do not use mitering of pipe to form elbows, notching straight runs to form full sized tees, or any similar construction. Make branch connections over 2 inches with welding tees except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ASME B31.9 may be used, provided the nominal diameter of the branch is at least one pipe size less than the nominal diameter of the run. Branch connections 2 inches and under can be threaded or welded. Run vertical piping plumb and straight and parallel to walls. Provide sleeves for lines passing through building structure. Provide a fire seal where pipes pass through fire wall, fire partitions, fire rated pipe chase walls, or floors above grade. Install piping connected to equipment with flexibility for thermal stresses and for vibration, and support and anchor so that strain from weight and thermal movement of piping is not imposed on the equipment.

3.2.1 Hangers and Supports

Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58. Band and secure insulation protection shields without damaging pipe insulation. Continuous inserts and expansion bolts may be used.

3.2.2 Grading of Pipe Lines

Unless otherwise indicated, install horizontal lines of hot water piping to grade down in the direction of flow with a pitch of not less than one inch in 30 feet, except in loop mains and main headers where the flow may be in either direction.

3.2.3 Unions

Provide unions to permit easy disconnection of piping and apparatus. Each connection having a screwed-end valve shall have a union. Place unions no farther apart than 100 feet. Install unions downstream of valves and at equipment or apparatus connections. Provide dielectric unions between ferrous and non-ferrous piping, equipment, and fittings; except that bronze valves and fittings may be used without dielectric couplings for ferrous-to-ferrous or non-ferrous-to-non-ferrous connections.

3.2.4 Changes in Pipe Size

Provide reducing fittings for changes in pipe size; reducing bushings are not permitted. In horizontal lines, provide eccentric reducing fittings to maintain the top of the lines in the same plane.

3.2.5 Cleaning of Pipe

Thoroughly clean each section of pipe, fittings, and valves free of foreign matter before erection. Prior to erection, hold each piece of pipe in an inclined position and tap along its full length to loosen sand, mill scale and other foreign matter. For pipe 2 inches and larger, draw wire brush, of a diameter larger than that of the inside of the pipe, several times through the entire length of pipe. Before making final connections to apparatus, wash out interior of piping thoroughly with water. Plug or cap open ends of mains during shutdown periods. Do not leave lines open where foreign matter might enter the pipe.

3.2.6 Valves

Install valves in conformance with ASME B31.9. Provide ball valves unless otherwise directed. Install valves with stems horizontal or above. Locate or equip stop valves to permit operation from floor level, or provide with safe access in the form of walkways or ladders. Install valves in positions accessible for operation and repair.

3.2.6.1 Globe Valves

Install globe valves so that the pressure is below the disk and the stem horizontal.

3.2.6.2 Relief Valves

Provide valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks. Select system relief valve so that capacity is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment. Pipe relief valve outlet to the nearest floor drain.

3.2.7 Pressure Gage

Provide a shut-off valve or pet cock between pressure gages and the line.

3.2.8 Thermometers

Provide thermometers and thermal sensing elements of control valves with a separable socket. Install separable sockets in pipe lines in such a manner to sense the temperature of flowing the fluid and minimize obstruction to flow.

3.2.9 Strainers

Provide strainers, with meshes suitable for the services, where indicated, or where dirt might interfere with the proper operation of valve parts, orifices, or moving parts of equipment.

3.2.10 Pumps

Select pumps for specified fluid temperatures, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve. Support piping adjacent to pump such that no weight is carried on pump casings. Install close coupled and base mounted pumps on concrete base, with anchor bolts, set and level, and grout in place and provide supports under elbows on pump suction and discharge line sizes 4 inches and over. Lubricate pump before start-up.

3.2.11 Equipment Foundations

Locate equipment foundations as shown on the drawings. Size, weight, and design shall preclude shifting of equipment under operating conditions. Foundations shall meet the requirements of the equipment manufacturer. Concrete shall conform to Section 03 30 00 CAST-IN-PLACE CONCRETE, and grout shall be approved non-shrinking.

3.2.12 Equipment Installation

Install equipment in accordance with installation instructions of the manufacturers. Grout equipment mounted on concrete foundations before installing piping. Install piping in such a manner as not to place a strain on the equipment. Do not bolt flanged joints tight unless they match. Grade, anchor, guide, and support piping without low pockets.

3.2.13 Cleaning of Systems

As installation of the various system components is completed, fill, start, and vent prior to cleaning. Place terminal control valves in open position. Add cleaner to closed system at concentration as recommended by manufacturer. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water. Circulate for 6 hours at design temperatures, then drain. Refill with clean water and repeat until system cleaner is removed. Use neutralizer agents on recommendation of system cleaner supplier and approval of Contracting Officer. Remove, clean, and replace strainer screens. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required. Preliminary or final tests are not permitted until cleaning is approved.

3.2.14 Painting of Piping and Equipment

Provide in accordance with Section 09 90 00 PAINTS AND COATINGS.

3.2.15 Identification of Piping

Identify piping in accordance with OSHA 29 CFR 1910.144, except that labels or tapes may be used in lieu of painting or stenciling. Spacing of identification marking on runs shall not exceed 50 feet. Materials for labels and tapes shall conform to CID A-A-1689, and shall be general purpose type and color class.

3.3 FIELD QUALITY CONTROL

Perform inspections and tests as specified herein to demonstrate that piping and equipment, as installed, is in compliance with contract requirements. Start up and operate the system. During this time, periodically clean the various strainers until no further accumulation of foreign material occurs. Exercise care so that minimum loss of water occurs when strainers are cleaned. Adjust safety and automatic control instruments to place them in proper operation and sequence.

3.3.1 Hydrostatic Test of Piping System

Test piping system hydrostatically using water not exceeding 100 degrees F. Conduct tests in accordance with the requirements of ASME B31.9 and as follows. Test piping system after all lines have been cleaned and before applying insulation covering. Remove or valve off from the system, gages, and other apparatus which may be damaged by the test before the tests are made. Install calibrated test pressure gage in the system to observe any loss in pressure. Maintain test pressure for a sufficient length of time to enable an inspection of each joint and connection. Perform tests after installation and prior to acceptance.Notify the Contracting Officer in writing 14 days prior to the time scheduled for the tests.

3.3.2 Auxiliary Equipment and Accessory Tests

Observe and check pumps, accessories, and equipment during operational and capacity tests for leakage, malfunctions, defects, noncompliance with referenced standards, or overloading.

3.4 TESTING, ADJUSTING, AND BALANCING

Test, adjust, and balance the hydronic system in accordance with Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

3.4.1 Markings of Settings

Following final acceptance of the balancing report, the settings of all valves, splitters, dampers, and other adjustment devices shall be permanently marked so that adjustment can be restored if disturbed at anytime.

-- End of Section --

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SECTION 23 52 00

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04/08

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SECTION 23 52 00

HEATING BOILERS
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 801	(2001; R 2008) Industrial Process/Power Generation Fans: Specification Guidelines

ASME INTERNATIONAL (ASME)

ASME B16.20	(2012) Metallic Gaskets for Pipe Flanges - Ring-Joint, Spiral Wound, and Jacketed
ASME B31.1	(2014; INT 1-47) Power Piping
ASME BPVC SEC IV	(2010) BPVC Section IV-Rules for Construction of Heating Boilers
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications
ASME CSD-1	(2012) Control and Safety Devices for Automatically Fired Boilers

ASTM INTERNATIONAL (ASTM)

ASTM D1784	(2011) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D596	(2001; R 2011) Reporting Results of Analysis of Water

HYDRONICS INSTITUTE DIVISION OF AHRI (HYI)

HI BTS-2000	(R 2007) Method to Determine Efficiency of Commercial Space Heating Boilers
HYI-005	(2008) I=B=R Ratings for Boilers, Baseboard Radiation and Finned Tube (Commercial)

UNDERWRITERS LABORATORIES (UL)

UL 1738	(2010; Reprint July 2014) Venting Systems

for Gas-Burning Appliances, Categories II, III and IV

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29SUSTAINABILITY REQUIREMENTS. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G, DO

SD-03 Product Data

Materials and Equipment; G, DO
Boiler Water Treatment; G, DO
Heating System Tests; G, AO
Welding; G, AO
Qualifications; G, AO
Field Instructions; G, AO
Tests; G, AO

SD-06 Test Reports

Heating System Tests; G, AO
Water Treatment Testing; G, AO

SD-07 Certificates

Energy Star; G, DO

SD-10 Operation and Maintenance Data

Operation and Maintenance Instructions; G, AO

1.3 QUALITY ASSURANCE

Submit a copy of qualified welding procedures and a list of names and identification symbols of qualified welders and welding operators, at least 2 weeks prior to the start of welding operations. Welded and brazed piping shall be in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. Notify the Contracting Officer 24 hours in advance of tests, and the tests shall be performed at the work site if practical. The welder or welding operator shall apply the personally assigned symbol near each weld made as a permanent record.

1.4 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

1.5 EXTRA MATERIALS

Submit spare parts data for each different item of material and equipment specified, after approval of the detail drawings and no later than 2 months prior to the date of beneficial occupancy. Submit Detail Drawings consisting of equipment layout including installation details and electrical connection diagrams; combustion and safety control diagrams; ductwork layout showing the location of supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of guides and anchors, the load imposed on each support or anchor ~~(not required for radiant floor tubing),~~ and typical support details. Include on the drawings any information required to demonstrate that the system has been coordinated and will properly function as a unit and to show equipment relationship to other parts of the work, including clearances required for operation and maintenance. Include in the data a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 and 3 years of service.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Standard Products

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Submit manufacturer's catalog data included with the detail drawings for the following:

~~a. Radiant floor heating system including tubing, joints, and manifold for radiant floor heating systems.~~

b. Data showing model, size, options, etc., that are intended for consideration. Data submitted shall be adequate to demonstrate compliance with contract requirements. Data shall include manufacturer's written installation instructions and manufacturer's recommendations for operation and maintenance clearances for the following:

(1) Boilers
(2) Unit Heaters
(3) Fuel Burning Equipment
(4) Combustion Control Equipment
(5) Pumps
(6) Fittings and Accessories~~(7) Fuel Oil Storage System~~
(7~~8~~) Water Treatment System

2.1.2 Asbestos Prohibition

Asbestos and asbestos-containing products will not be allowed.

2.1.3 Nameplates

Secure a plate to each major component of equipment containing the manufacturer's name, address, type or style, model or serial number, and catalog number. Also, display an ENERGY STAR label as applicable. Each pressure vessel shall have an approved ASME stamp.

2.1.4 Equipment Guards

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded in accordance with OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

2.2 BOILERS

Each boiler shall have the output capacity in British thermal units per hour (Btuh) as indicated when fired with the specified fuels. The boiler shall be furnished complete with the gas burning equipment, boiler fittings and trim, automatic controls, forced draft fan, electrical wiring, insulation, piping connections, and protective jacket. The boiler shall be completely assembled and tested at the manufacturer's plant. Boiler auxiliaries including fans, motors, drives, and similar equipment shall be provided with at least 10 percent excess capacity to allow for field variations in settings and to compensate for any unforeseen increases in pressure losses in appurtenant piping and ductwork. However, the boiler safety devices shall not be sized for a 10 percent excess capacity. The boiler and its accessories shall be designed and installed to permit ready accessibility for operation, maintenance, and service. Boilers shall be designed, constructed, and equipped in accordance with ASME BPVC SEC IV. Each boiler shall be of the condensing type and designed for water service as indicated on the drawings. The boiler capacity shall be based on the ratings shown in HYI-005 or as certified by the American Boiler Manufacturers Association, or American Gas Association.

2.2.1 Condensing Boiler

Each boiler shall be a self-contained packaged type, complete with accessories, mounted on a structural steel base or a steel base which is integral to the boiler shell. Each boiler shall conform to the commercial design used by the manufacturer and shall permit free thermal expansion without placing undue stress on any part of the boiler. Each boiler which experiences the formation of condensate within the flue gas shall be specifically designed for condensing application. Each boiler shall withstand the corrosive effects of condensate for each part which may be in contact with the condensate at all possible operating conditions. Each boiler shall be provided with a separate air intake, exhaust, and condensate drain. Each boiler shall be designed to withstand the water temperature differentials anticipated at the required operating conditions without experiencing any damage due to thermal shock.

For boilers that meet the definition of a residential boiler (less than 300,000 Btuh), selected boilers must meet performance requirements specified by ENERGY STAR. Information on the requirements can be found at: http://www.energystar.gov/ia/partners/product_specs/program_reqs/Boilers_Program_Requirements.pdf.

Condensing boilers with a capacity less than 300,000 Btuh must meet ENERGY STAR performance requirements and be ENERGY STAR listed. Verify that the boiler is ENERGY STAR qualified by checking the ENERGY STAR list of Cerfified Boilers at: https://data.energystar.gov/

Condensing boilers with a capacity greater than or equal to 300,000 Btuh must meet performance requirements specified by FEMP. Information on the requirements can be found at: http://energy.gov/eere/femp/energy-efficient-product-procurement.

The link for energy requirements for all commercial boilers is found at: http://energy.gov/eere/femp/covered-product-category-commercial-boilers (Efficiences are based on HI BTS-2000 Method to Determine Efficiency of Commercial Space Heating Boilers from the Hydronics Institute.).

2.2.2 Hot Water Heating Boilers

The hot water heating boiler shall be capable of operating at the specified maximum continuous capacity without damage or deterioration to the boiler, its setting, firing equipment, or auxiliaries. The rated capacity shall be the capacity at which the boiler will operate continuously while maintaining at least the specified minimum efficiency.

2.3 FUEL BURNING EQUIPMENT

Boiler shall be designed to burn gas. Each boiler shall comply with Federal, state, and local emission regulations.

2.3.1 Burners

2.3.1.1 Gas Fired Burners and Controls

Burners shall be UL approved mechanical draft burners with all air necessary for combustion supplied by a blower where the operation is coordinated with the burner. —

2.3.2 Draft Fans

Fans conforming to AMCA 801 shall be furnished as an integral part of boiler design. Fans shall be centrifugal with or axial flow type. Each fan shall be sized for output volume and static pressure rating sufficient for pressure losses, excess air requirements at the burner, leakages, temperature, and elevation corrections for worst ambient conditions, all at full combustion to meet net-rated output at normal firing conditions, plus an overall excess air volume of 10 percent against a 20 percent static overpressure. Noise levels for fans shall not exceed 85 decibels in any octave band at a 3 foot station. Forced draft fan bearings shall be air cooled. Induced-draft fans shall be designed for handling hot flue gas at the maximum outlet temperature in the boiler. Induced draft fan housings shall be provided with drain holes to accommodate the drainage of condensation. Induced draft fan bearings shall be air-cooled.

2.3.2.1 Draft Fan Drives

Fans shall be driven by electric motors. Electric motor shall be drip proof, suitable for the application.

~~2.3.3 Ductwork~~

~~Air ducts supplying combustion air to the forced draft fan units shall be designed to convey air with a minimum of pressure loss due to friction. Ductwork shall be galvanized sheet metal conforming to ASTM A653/A653M or pvc, as recommended by the boiler manufacturer. Ducts shall be constructed with long radius elbows having a centerline radius 1-1/2 times the duct width, or where the space does not permit the use of long radius elbows, short radius or square elbows with factory fabricated turning vanes may be used. Duct joints shall be substantially airtight and shall have adequate strength for the service~~

2.4 COMBUSTION CONTROL EQUIPMENT

Combustion control equipment shall be provided as a system by a single manufacturer. Field installed automatic combustion control system shall be installed in accordance with the manufacturer's recommendations and under the direct supervision of a representative of the control manufacturer. The boiler water temperature shall be controlled by a water temperature controller. On multiple boiler installations, each boiler unit shall have a completely independent system of controls responding to the load and to a plant master controller.

2.4.1 Electrical controls

Electrical control devices shall be rated at 120 or 24 volts and shall be connected as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.4.2 Water Temperature Controller

The controller shall be of sturdy construction and shall be protected against dust and dampness. The thermostatic element shall be inserted in a separable socket installed in the upper part of the boiler near the water outlet. Modulating controllers shall control the fuel burning equipment to maintain set boiler water temperature within 2 percent. Controller shall be furnished with necessary equipment to automatically adjust the setting to suit the outside weather conditions, based on input from the building HVAC control system. The outside air reset controller shall be operated in such a manner that the operating temperatures required by the boiler manufacturer are not compromised.

2.4.3 Boiler Plant Master Controller

A boiler plant master controller shall be furnished to provide anticipatory signals to all boiler controllers. Boiler controllers shall react to anticipatory signals from the plant master controller as necessary in response to the boiler temperature indication to maintain the preset temperature. An automatic-manual switch shall be provided to allow the sequence of boiler loading to be varied to distribute equal firing time on all boilers in the plant. The plant master controller shall load the boilers one at a time as the plant load increases, unless recommended otherwise by the boiler manufacturer.

2.4.4 Combustion Safety Controls and Equipment

Combustion safety controls and equipment shall be UL listed, microprocessor-based distributed process controller. The system shall include mounting hardware, wiring and cables, and associated equipment. The controller shall be mounted completely wired, programmed, debugged, and

tested to perform all of its functions. The controller shall process the signals for complete control and monitoring of the boiler. This shall include maintaining boiler status, starting and stopping all control functions, sequencing control functions and signaling alarm conditions. The program shall be documented and include cross references in description of coils and contacts. Microprocessor shall be able to perform self diagnostics and contain a message center to provide operator with status and failure mode information. Controllers for each boiler shall be mounted on a separate, free standing panel adjacent to the boiler or for packaged boilers on the boiler supporting structure. Control systems and safety devices for automatically fired boilers shall conform to ASME CSD-1. A manual safety shutdown switch or button shall be provided where indicated on the drawings. Activation of the manual safety shutdown shall discontinue operation of the boilers and provide an alarm indication to the building HVAC control system. Electrical combustion and safety controls shall be rated at 120 volts, single phase, 60 Hz and shall be connected as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. A 4 inch diameter alarm bell shall be provided and shall be located where indicated or directed. The alarm bell shall ring when the boiler is shut down by any safety control or interlock. Indicating lights shall be provided on the control panel. A red light shall indicate flame failure, and a green light shall indicate that the main fuel valve is open. The following shutdown conditions shall require a manual reset before the boiler can automatically recycle:

a. Flame failure.

b. Failure to establish pilot flame.

c. Failure to establish main flame.

d. Low-water cutoff.

e. High temperature cutoff.

2.4.4.1 Low-water Cutoff

Low water cutoff shall be float actuated switch or electrically actuated probe type low-water cutoff. Float chamber (where utilized by the boiler manufacturer) shall be provided with a blow-down connection. Cutoff shall cause a safety shutdown and sound an alarm when the boiler water level drops below a safe minimum level. A safety shutdown due to low water shall require manual reset before operation can be resumed and shall prevent recycling of the burner. The cutoff shall be in strict accordance to the latest version of code,ASME CSD-1 Controls and Safety Devices for Automatically Fired Boilers.

2.4.4.2 Water Flow Interlock

Hot water boiler limit controls shall be provided to include protection for low boiler water flow and high boiler water temperature. The limit controls shall be interlocked with the combustion control system to effect boiler alarm and shutdown. The controls shall not allow boiler startup unless hot water flow is proven.

2.5 PUMPS

2.5.1 Boiler Circulating Pumps

Circulating pumps shall be electrically driven single-stage centrifugal type and have a capacity not less than indicated. Boiler circulating pumps shall be supported by the piping on which installed and shall be closed-coupled shaft or flexible-coupled shaft.

~~2.6 AIR HANDLING UNITS~~

~~Air handling units and associated equipment shall be in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.~~

2.6 FITTINGS AND ACCESSORIES

Boiler fittings and accessories shall be installed with each boiler in accordance with ASME BPVC SEC IV, unless otherwise specified.

2.6.1 Direct Vents

Direct venting shall be used for condensing type boilers. Both the air intake and exhaust vents shall be sized and located as indicated on the drawings and as recommended by the boiler manufacturer. A separate combustion air intake vent and exhaust vent shall be provided for each boiler.

2.6.1.1 Combustion Air Intake Vent

Each boiler shall be provided with a ~~The~~ combustion air intake ~~piping shall be~~ constructed of Schedule 40 PVC in accordance with ASTM D1784 or material recommended by the boiler manufacturer. The material~~vent~~ shall be suitable for the temperature at the boiler combustion air intake connection point. Each intake shall be provided complete with bird screen.

2.6.1.2 Exhaust Vent

Each boiler shall be provided with an~~The~~ exhaust vent ~~piping shall be~~ constructed of Schedule 40 CPVC or stainless steel conforming to UL 1738 and the boiler manufacturer's recommendations. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases. The exhaust vent shall be suitable for the maximum anticipated boiler exhaust temperature and shall withstand the corrosive effects of the condensate. A 0.3125 inch diameter hole shall be provided in the vent~~stack~~ not greater than 6 inches from the boiler flue outlet for sampling of the exit gases. A method shall be provided to seal the hole to prevent exhaust gases from entering the boiler room when samples are not being taken. Each exhaust vent~~stack~~ shall be provided complete with bird screen.

2.6.2 Gaskets

Gaskets shall be nonasbestos material in accordance with ASME B16.20, full face or self-centering type. The gaskets shall be of the spiral wound type with graphite filler material.

2.7 ELECTRICAL EQUIPMENT

Electric motor-driven equipment shall be provided complete with motors,

motor starters, and necessary control devices. Electrical equipment, motor control devices, motor efficiencies and wiring shall be as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Motors which are an integral part of the packaged boiler shall be the highest efficiency available by the manufacturer of the packaged boiler.

2.7.1 Motor Ratings

Motors shall be suitable for the voltage and frequency provided. Motors 1/2 hp and larger shall be three-phase, unless otherwise indicated. Motors shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating on the motor.

2.8 INSULATION

Shop and field-applied insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.9 TOOLS

Special tools shall be furnished. Special tools shall include uncommon tools necessary for the operation and maintenance of boilers, burners, pumps, fans, controls, meters, special piping systems, and other equipment. Small hand tools shall be furnished within a suitable cabinet, mounted where directed.

2.10 BOILER WATER TREATMENT

Submit three complete copies of the proposed water treatment plan. The plan shall include a layout, control scheme, a list of the existing water conditions including the items listed in this paragraph, a list of all chemicals, the proportion of chemicals to be added, the final treated water conditions, and a description of environmental concerns for handling the chemicals. The water treatment system shall be capable of feeding chemicals and bleeding the system. The final fill of the heating water system shall include propylene glycol (at the concentration level indicated on the drawings) and additional chemical required to prevent corrosion and scale within the boiler and piping distribution system. Submit three complete copies of operating and maintenance manuals for the step-by-step water treatment procedures, including procedures for testing the water quality. The water shall be treated to maintain the conditions recommended by the boiler manufacturer. Chemicals shall meet required federal, state, and local environmental regulations for the treatment of boilers and discharge to the sanitary sewer. The services of a water treatment company regularly engaged in the treatment of boilers shall be used to determine the correct chemicals and concentrations required for water treatment. The water treatment company shall maintain the chemical treatment and provide all chemicals required for a period of 1 year from the date of occupancy. Filming amines and proprietary chemicals shall not be used. The water treatment chemicals shall remain stable throughout the operating temperature range of the system and shall be compatible with pump seals and other elements of the system. The water treatment company shall submit a report indicating the recommended chemicals, the concentration level for each chemical and the purpose for each chemical.

2.10.1 Boiler Water Limits

The boiler manufacturer shall be consulted for the determination of the boiler water chemical composition limits. The boiler water limits shall be

as follows unless dictated differently by the boiler manufacturer's recommendations:

Causticity	20-200 ppm
Total Alkalinity (CACO3)	900-1200 ppm
Phosphate	30-60 ppm
Tanin	Medium
Dissolved Solids	3000-5000 ppm
Suspended Solids	300 ppm Max
Sodium Sulfite	20-40 ppm Max
Silica	Less than 150 ppm
Dissolved Oxygen	Less than 7 ppm
Iron	10 ppm
pH (Condensate)	7 - 8

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work or ordering any materials.

3.2 GAS FUEL SYSTEM

Gas piping, fittings, valves, regulators, tests, cleaning, and adjustments shall be in accordance with the Section 23 11 25 FACILITY GAS PIPING.

3.3 COLOR CODE MARKING AND FIELD PAINTING

Color code marking of piping shall conform to ASME A13.1.

3.4 MANUFACTURER'S SERVICES

Provide the services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified to supervise the installing, adjusting, and testing of the equipment.

3.5 HEATING SYSTEM TESTS

Submit the Qualifications of the firms in charge of installation and testing as specified. Submit a statement from the firms proposed to prepare submittals and perform installation and testing, demonstrating successful completion of similar services of at least five projects of similar size or scope, at least 2 weeks prior to the submittal of any other item required by this section. Before any covering is installed on pipe or

heating equipment, the entire heating system's piping, fittings, and terminal heating units shall be hydrostatically tested and proved tight at a pressure of 1.5 times the design working pressure, but not less than 100 psi. Submit proposed test procedures for the heating system tests and fuel system tests, at least 2 weeks prior to the start of related testing.

a. Before pressurizing system for test, items or equipment (e.g., vessels, pumps, instruments, controls, relief valves) rated for pressures below the test pressure shall be blanked off or replaced with spool pieces.

b. Before balancing and final operating test, test blanks and spool pieces shall be removed; and protected instruments and equipment shall be reconnected. With equipment items protected, the system shall be pressurized to test pressure. Pressure shall be held for a period of time sufficient to inspect all welds, joints, and connections for leaks, but not less than 2 hours. No loss of pressure will be allowed. Leaks shall be repaired and repaired joints shall be retested.

~~c. Repair joints shall not be allowed under the floor for floor radiant heating systems. If a leak occurs in tubing located under the floor in radiant heating systems, the entire zone that is leaking shall be replaced. If any repair is made above the floor for floor radiant heating systems, access shall be provided for the installed joint. Caulking of joints shall not be permitted.~~

d. System shall be drained and after instruments and equipment are reconnected, the system shall be refilled with service medium and maximum operating pressure applied. The pressure shall be held while inspecting these joints and connections for leaks. The leaks shall be repaired and the repaired joints retested.

Upon completion of hydrostatic tests and before acceptance of the installation, submit test reports for the heating system tests. Upon completion of testing complete with results, balance the heating system in accordance with Section 23 05 93 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS and operating tests required to demonstrate satisfactory functional and operational efficiency. The operating test shall cover a period of at least 24 hours for each system, and shall include, as a minimum, the following specific information in a report, together with conclusions as to the adequacy of the system:

a. Certification of balancing.

b. Time, date, and duration of test.

c. Outside and inside dry bulb temperatures.

d. Temperature of hot water supply leaving boiler.

e. Temperature of heating return water from system at boiler inlet.

f. Quantity of water feed to boiler.

g. Boiler make, type, serial number, design pressure, and rated capacity.

h. Fuel burner make, model, and rated capacity; ammeter and voltmeter readings for burner motor.

o. Quantity of water circulated.

p. Quantity of fuel consumed.

Indicating instruments shall be read at half-hour intervals unless otherwise directed. Furnish all instruments, equipment, and personnel required for the tests and balancing.

3.5.1 Water Treatment Testing

The boiler water shall be analyzed prior to the acceptance of the facility and once a month for a period of 1 year by the water treatment company. Submit a water quality test report identifying the chemical composition of the boiler water. The report shall include a comparison of the condition of the boiler water with the manufacturer's recommended conditions. Any required corrective action shall be documented within the report. The test report shall identify the condition of the boiler at the completion of 1 year of service. The report shall include a comparison of the condition of the boiler with the manufacturer's recommended operating conditions. The analysis shall include the following information recorded in accordance with ASTM D596.

Date of Sample	_____
Temperature	_____ degrees F
Silica (SiO2)	_____ ppm (mg/1)
Insoluble	_____ ppm (mg/1)
Iron and Aluminum Oxides	_____ ppm (mg/1)
Calcium (Ca)	_____ ppm (mg/1)
Magnesium (Mg)	_____ ppm (mg/1)
Sodium and Potassium (Na and K)	_____ ppm (mg/1)
Carbonate (HCO3)	_____ ppm (mg/1)
Sulfate (SO4)	_____ ppm (mg/1)
Chloride (C1)	_____ ppm (mg/1)
Nitrate (NO3)	_____ ppm (mg/1)
Turbidity	_____ ntu
pH	_____
Residual Chlorine	_____ ppm (mg/1)
Total Alkalinity	_____ epm (meq/1)
Noncarbonate Hardness	_____ epm (meq/1)

Total Hardness	_____ epm (meq/1)
Dissolved Solids	_____ ppm (mg/1)
Fluorine	_____ ppm (mg/1)
Conductivity	_____ micro-mho/cm

If the boiler water is not in conformance with the boiler manufacturer's recommendations, the water treatment company shall take corrective action.

3.5.2 Boiler/Piping Test

At the conclusion of the 1 year period, the boiler and condensate piping shall be inspected for problems due to corrosion and scale. If the boiler is found not to conform to the manufacturer's recommendations, and the water treatment company recommendations have been followed, the water treatment company shall provide all chemicals and labor for cleaning or repairing the equipment as required by the manufacturer's recommendations. If corrosion is found within the condensate piping, proper repairs shall be made by the water treatment company.

3.6 CLEANING

3.6.1 Boilers and Piping

After the hydrostatic tests have been made and before the system is balanced and operating tests are performed, the boilers and piping shall be thoroughly cleaned by filling the system with a solution consisting of either 1 pound of caustic soda or 1 pound of trisodium phosphate per 50 gallons of water. The proper safety precautions shall be observed in the handling and use of these chemicals. The water shall be heated to approximately 150 degrees F and the solution circulated in the system for a period of 48 hours. The system shall then be drained and thoroughly flushed out with fresh water. Strainers and valves shall be thoroughly cleaned. Prior to operating tests, air shall be removed from all water systems by operating the air vents.

3.7 FIELD TRAINING

Conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 4 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests.

a. The field instructions shall cover all of the items contained in the approved operation and maintenance manuals, as well as demonstrations of routine maintenance operations and boiler safety devices.

c. Submit three complete operation and maintenance instructions listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, simplified wiring and control diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization shall be capable of providing 4 hour onsite response to a

service call on an emergency basis.

d. Notify the Contracting Officer at least 14 days prior to date of proposed conduction of the training course.

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SECTION 28 31 49

CARBON MONOXIDE DETECTORS
04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3 2014) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 2034	(2008; Reprint Feb 2009) Single and Multiple Station Carbon Monoxide Alarms

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Carbon monoxide detectorAO

SD-06 Test Reports

Carbon monoxide detector testAO

SD-10 Operation and Maintenance Data

Carbon monoxide detector; Data Package 1AO

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.AO

PART 2 PRODUCTS

2.1 CARBON MONOXIDE DETECTOR

UL 2034, Single station and Multiple station detector surface mounted. Operational requirements shall be as follows:

a. Electrical: 120 Volt AC with 9 volt battery backup volt DC

b. Environmental: 32 degrees to 120 degrees F.

c. Alarm and Indicator: Red LED for visual and 85 db at 10 ft for audible alarm. Malfunction indicator light shall be yellow or amber LED. Power on indicator light shall be white or green for 120 Volt AC powered units, while operating on AC power.

d. Alarm reset/silence button: Provide a manually operated alarm reset and silence button. Pressing the button shall silence the alarm, and reset the detector. Alarm shall resound within 6 minutes if CO level remains at or above 70 ppm.

e. Battery removal flag: Provide a warning flag that will be exposed while the battery is removed, and hidden while the battery is installed.

2.2 CONDUIT, BOXES, AND FITTINGS

Specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.3 WIRES AND CABLES

Specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Electrical work

Electrical installation shall conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and NFPA 70.

3.1.2 Carbon Monoxide Detector

Install detectors in accordance with the manufacturer's instructions. Provide detector in hallway outside bedrooms, , and in locations as indicated.

3.1.3 Grounding and Bonding

Equipment grounding and bonding shall be in accordance with UL 2034 and NFPA 70.

3.2 FIELD QUALITY CONTROL

Provide test equipment and personnel and submit written copies of the test results. Notify Contracting Officer 15 working days prior to the test.

3.2.1 Carbon Monoxide Detector Test

Contractor shall show by demonstration in service that the detectors arein

good condition and properly performing the intended function. Test shall be in accordance with UL 2034 requirements specified in paragraph entitled "Normal Operation Test" and the manufacturer's test procedure.

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SECTION 28 31 76

INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM
08/11

PART 1 GENERAL

1.1 RELATED SECTIONS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein. In addition, refer to the following sections for related work and coordination:

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS
Section 21 21 00 FIRE EXTINGUISHING SPRINKLER SYSTEMS (RESIDENTIAL)
Section 08 71 00 DOOR HARDWARE for door release and additional work related to finish hardware.
Section 07 84 00 FIRESTOPPING for additional work related to firestopping.

1.2 SUMMARY

1.2.1 Scope

a. This work includes completion of design and providing a new, complete, fire alarm and mass notification system as described herein and on the contract drawings for the CAVALIER DORMITORY. Include in the system wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm, and supervisory signal initiating devices, alarm notification appliances, supervising station fire alarm system transmitter, and other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described. Provide systems complete and ready for operation.

b. Provide equipment, materials, installation, workmanship, inspection, and testing in strict accordance with the required and advisory provisions of NFPA 72, ISO 7240-16, IEC 60268-16, except as modified herein. The system layout on the drawings show the intent of coverage and are shown in suggested locations. Submit plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, wire counts, circuit identification in each conduit, and circuit layouts for all floors. Drawings shall comply with the requirements of NFPA 170. Final quantity, system layout, and coordination are the responsibility of the Contractor.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S3.2	(2009; R 2014) Method for Measuring the Intelligibility of Speech Over Communication Systems (ASA 85)

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 60268-16	(2003; ED 4.0) Sound System Equipment - Part 16: Objective Rating Of Speech Intelligibility By Speech Transmission Index

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 7240-16	(2007) Fire Detection And Alarm Systems — Part 16: Sound System Control And Indicating Equipment
ISO 7240-19	(2007) Fire Detection and Alarm Systems — Part 19: Design, Installation, Commissioning and Service of Sound Systems for Emergency Purposes

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 170	(2012) Standard for Fire Safety and Emergency Symbols
NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3 2014) National Electrical Code
NFPA 72	(2013) National Fire Alarm and Signaling Code
NFPA 90A	(2015) Standard for the Installation of Air Conditioning and Ventilating Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-601-02	(2010) Operations and Maintenance: Inspection, Testing, and Maintenance of Fire Protection Systems

UFC 4-021-01	(2008; Change 1 2010) Design and O&M: Mass Notification Systems

UNDERWRITERS LABORATORIES (UL)

UL 1480	(2003; Reprint Oct 2012) Standard for Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
UL 1638	(2001; Reprint Oct 2013) Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling
UL 1971	(2002; Reprint Oct 2008) Signaling Devices for the Hearing Impaired
UL 2017	(2008; Reprint May 2011) General-Purpose Signaling Devices and Systems
UL 268	(2009) Smoke Detectors for Fire Alarm Systems
UL 464	(2009; Reprint Apr 2012) Standard for Audible Signal Appliances
UL 521	(1999; Reprint May 2010) Heat Detectors for Fire Protective Signaling Systems
UL 864	(2003; Reprint Aug 2012) Standard for Control Units and Accessories for Fire Alarm Systems
UL Electrical Constructn	(2012) Electrical Construction Equipment Directory
UL Fire Prot Dir	(2012) Fire Protection Equipment Directory

1.4 DEFINITIONS

Wherever mentioned in this specification or on the drawings, the equipment, devices, and functions shall be defined as follows:

1.4.1 Interface Device

An addressable device that interconnects hard wired systems or devices to an analog/addressable system.

1.4.2 Remote Fire Alarm and Mass Notification Control Unit

A control panel, electronically remote from the fire alarm and mass notification control panel, that receives inputs from automatic and manual fire alarm devices; may supply power to detection devices and interface devices; may provide transfer of power to the notification appliances; may provide transfer of condition to relays or devices connected to the control unit; and reports to and receives signals from the fire alarm control panel.

1.4.3 Fire Alarm Control Unit and Mass Notification Autonomous Control Unit (FMCP)

A master control panel having the features of a fire alarm and mass notification control unit and fire alarm and mass notification control units are interconnected. The panel has central processing, memory, input and output terminals, and LCD, LED Display units.

1.4.4 Local Operating Console (LOC)

A unit designed to allow emergency responders and/or building occupants to operate the MNS including delivery or recorded and/or live messages, initiate strobe and textural visible appliance operation and other relayed functions.

1.4.5 Terminal Cabinet

A steel cabinet with locking, hinge-mounted door that terminal strips are securely mounted.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval.information only. When used, a designation following the "AO" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29SUSTAINABILITY REQUIREMENTS. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Nameplates AO
Instructions AO
Wiring Diagrams DO
System Layout DO
System Operation AO
Notification Appliances DO
Amplifiers AO

SD-03 Product Data

Technical Data And Computer Software
Fire Alarm Control Unit and Mass Notification Control Unit (FMCP); DO
LCD, LED Display Unit (VDU) DO
Terminal cabinets
Manual stations AO
Transmitters (including housing)
Batteries AO
Battery chargers AO
Smoke sensors DO
Heat detectors DO
Notification appliances DO
Addressable interface devices DO
Amplifiers
Tone generators DO
Digitalized voice generators DO

Remote Fire Alarm/Mass Notification Control UnitsDO,AO
Digital alarm communicator transmitter (DACT)DO
Local Operating Console (LOC)DO

SD-05 Design Data

Battery powerDO
Battery chargersDO

SD-06 Test Reports

Field Quality Control
Testing ProceduresAO
Smoke sensor testing proceduresAO

SD-07 Certificates

Installer
Formal Inspection and Tests
Final Testing

SD-09 Manufacturer's Field Reports

System OperationAO
Fire Alarm/Mass Notification System

SD-10 Operation and Maintenance Data

Operation and Maintenance (O&M) InstructionsAO
Instruction of Government Employees

SD-11 Closeout Submittals

As-Built Drawings

1.6 TECHNICAL DATA AND COMPUTER SOFTWARE

Technical data and computer software (meaning technical data that relates to computer software) that are specifically identified in this project, and may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES. Identify data delivered by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

a. Identification of programmable portions of system equipment and capabilities.

b. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.

c. Provision of operational software data on all modes of programmable portions of the fire alarm and detection system.

d. Description of Fire Alarm and Mass Notification Control Panel equipment operation.

e. Description of auxiliary and remote equipment operations.

f. Library of application software.

g. Operation and maintenance manuals.

1.7 QUALITY ASSURANCE

Equipment and devices shall be compatible and operable with existing station fire alarm system and shall not impair reliability or operational functions of existing supervising station fire alarm system. .

a. In NFPA publications referred to herein, consider advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; interpret reference to "authority having jurisdiction" to mean the Air Force Civil Engineer Support Agency, Fire Protection Engineering Subject Matter Expert.

b. The recommended practices stated in the manufacturer's literature or documentation shall be considered as mandatory requirements.

c. Devices and equipment for fire alarm service shall be listed by UL Fire Prot Dir or approved by FM APP GUIDE.

1.7.1 Qualifications

1.7.1.1 Design Services

Installations requiring completion of installation drawings and specification or modifications of fire detection, fire alarm, mass notification system, fire suppression systems or mass notification systems shall require the services and review of a qualified engineer. For the purposes of meeting this requirement, a qualified engineer is defined as an individual meeting one of the following conditions:

a. A registered professional engineer having a Bachelor of Science or Masters of Science Degree in Fire Protection Engineering from an accredited university engineering program, plus a minimum of four years work experience in fire protection engineering.

b. A registered professional engineer (P.E.) in fire protection engineering.

c. Registered Professional Engineer with verification of experience and at least five years of current experience in the design of the fire protection and detection systems.

1.7.1.2 Supervisor

NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level 4 Fire Alarm Technician shall supervise the installation of the fire alarm system/mass notification system. The Fire Alarm technicians supervising the installation of equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.7.1.3 Technician

Fire Alarm Technicians with a minimum of four years of experience utilized

to install and terminate fire alarm/mass notification devices, cabinets and panels. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.7.1.4 Installer

Fire Alarm installer with a minimum of two years of experience utilized to assist in the installation of fire alarm/mass notification devices, cabinets and panels. An electrician shall be allowed to install wire, cable, conduit and backboxes for the fire alarm system/mass notification system. The Fire Alarm installer shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.7.1.5 Test Personnel

Fire Alarm Technicians with a minimum of eight years of experience (NICET Level III)utilized to test and certify the installation of the fire alarm/mass notification devices, cabinets and panels. The Fire Alarm technicians testing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.7.1.6 Manufacturer's Representative

The fire alarm and mass notification equipment manufacturer's representative shall be present for the connection of wiring to the control panel. The Manufacturer's Representative shall be an employee of the manufacturer with necessary technical training (NICET Level III)on the system being installed.

1.7.1.7 Manufacturer

Components shall be of current design and shall be in regular and recurrent production at the time of installation. Provide design, materials, and devices for a protected premises fire alarm system, complete, conforming to NFPA 72, except as otherwise or additionally specified herein.

1.7.2 Regulatory Requirements

1.7.2.1 Requirements for Fire Protection Service

Equipment and material shall have been tested by UL and listed in UL Fire Prot Dir or approved by FM and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, they shall mean listed in UL Fire Prot Dir or FM APP GUIDE. The omission of these terms under the description of any item of equipment described shall not be construed as waiving this requirement. All listings or approval by testing laboratories shall be from an existing ANSI or UL published standard.

1.7.2.2 Fire Alarm/Mass Notification System

Furnish equipment that is compatible and is UL listed, FM approved, or listed by a nationally recognized testing laboratory for the intended use. All listings by testing laboratories shall be from an existing ANSI or UL published standard. Submit a unique identifier for each device, including the control panel and initiating and indicating devices, with an indication of test results, and signature of the factory-trained technician of the

control panel manufacturer and equipment installer. With reports on preliminary tests, include printer information. Include the NFPA 72 Record of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

1.7.2.3 Fire alarm Testing Services or Laboratories

construct fire alarm and fire detection equipment in accordance with UL Fire Prot Dir, UL Electrical Constructn, or FM APP GUIDE.

1.8 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity, and temperature variation, dirt and dust, and other contaminants.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Submit annotated catalog data as required in the paragraph SUBMITTAL, in table format on the drawings, showing manufacturer's name, model, voltage, and catalog numbers for equipment and components. Submitted shop drawings shall not be smaller than ISO A1. Also provide UL or FM listing cards for equipment provided.

2.1.1 Standard Products

Provide materials, equipment, and devices that have been tested by a nationally recognized testing laboratory, such as UL or FM Approvals, LLC (FM), and listed or approved for fire protection service when so required by NFPA 72 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for any particular classification of materials. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least two years prior to bid opening.

2.1.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new plate permanently affixed to the item or equipment. Major components include, but are not limited to, the following:

a. FMCPs

b. Automatic transmitter/transceiver

c. Terminal Cabinet

Furnish nameplate illustrations and data to obtain approval by the Contracting Officer before installation. Obtain approval by the Contracting Officer for installation locations. Nameplates shall be etched metal or plastic, permanently attached by screws to panels or adjacent walls.

2.1.3 Keys

Keys and locks for equipment shall be identical. Provide not less than six

keys of each type required. Master all keys and locks to a single key as required by the Installation Fire Department.

LOC is not permitted to be locked or lockable.

2.2 GENERAL PRODUCT REQUIREMENT

All fire alarm and mass notification equipment shall be listed for use under the applicable reference standards. Interfacing of Listed UL 864 or similar approved industry listing with Mass Notification Panels listed to UL 2017 shall be done in a laboratory listed configuration, if the software programming features cannot provide a listed interface control. If a field modification is needed, such as adding equipment like relays, the manufacturer of the panels being same or different brand from manufacturer shall provide the installing contractor for review and confirmation by the installing contractor. As part of the submittal documents, provide this information.

2.3 SYSTEM OPERATION

The Addressable Interior Fire Alarm and Mass Notification System shall be a complete, supervised, noncoded, analog/addressable fire alarm and mass notification system conforming to NFPA 72, UL 864 , and UL 2017. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the control panel is reset and restored to normal. The system may be placed in the alarm mode by local microphones, LOC, or remotely from authorized locations/users.

Submit data on each circuit to indicate that there is at least 25 percent spare capacity for notification appliances, 25 percent spare capacity for initiating devices. Annotate data for each circuit on the drawings. Submit a complete description of the system operation in matrix format on the drawings. Submit a complete list of device addresses and corresponding messages.

2.3.1 Alarm Initiating Devices and Notification Appliances (Visual, Voice, Textural)

a. Connect alarm initiating devices to initiating device circuits (IDC) and installed in accordance with NFPA 72.
b. Connect alarm notification appliances and speakers to notification appliance circuits (NAC).

c. The system shall operate in the alarm mode upon actuation of any alarm initiating device or a mass notification signal. The system shall remain in the alarm mode until initiating device(s) or mass notification signal is/are reset and the control panel is manually reset and restored to normal. Audible, and visual appliances and systems shall comply with NFPA 72 and as specified herein. Fire alarm system/mass notification system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc.

2.3.2 Functions and Operating Features

The system shall provide the following functions and operating features:

a. The FMCP shall provide power, annunciation, supervision, and control for the system. Addressable systems shall be microcomputer

(microprocessor or microcontroller) based with a minimum word size of eight bits with sufficient memory to perform as specified.

b. For Class "A" or "X" circuits with conductor lengths of 3m (10 feet) or less, the conductors shall be permitted to be installed in the same raceway in accordance with NFPA 72.

c. Provide signaling line circuits for each floor.

d. Provide signaling line circuits for the network.

e. Provide notification appliance circuits. The visual alarm notification appliances shall have the flash rates synchronized as required by NFPA 72.

f. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.

g. Provide an audible and visual trouble signal to activate upon a single break or open condition, or ground fault (or short circuit for Class "X"). The trouble signal shall also operate upon loss of primary power (AC) supply, absence of a battery supply, low battery voltage, or removal of alarm or supervisory panel modules. Provide a trouble alarm silence feature that shall silence the audible trouble signal, without affecting the visual indicator. After the system returns to normal operating conditions, the trouble signal shall again sound until the trouble is acknowledged. A smoke sensor in the process of being verified for the actual presence of smoke shall not initiate a trouble condition.

h. Provide program capability via switches in a locked portion of the FACP to bypass the automatic notification appliance circuits, fire reporting systemair handler shutdown, smoke control operation features. Operation of this programming shall indicate this action on the FACP display and printer output.

i. Alarm, supervisory, and/or trouble signals shall be automatically transmitted to the fire department..

j. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.

k. The system shall be capable of being programmed from the panels keyboard. Programmed information shall be stored in non-volatile memory.

l. The system shall be capable of operating, supervising, and/or monitoring both addressable and non-addressable alarm and supervisory devices.

m. There shall be no limit, other than maximum system capacity, as to the number of addressable devices, that may be in alarm simultaneously.

n. Where the fire alarm/mass notification system is responsible for initiating an action in another emergency control device or system, such as an HVAC system, the addressable fire alarm relay shall be in the vicinity of the emergency control device.

o. An alarm signal shall automatically initiate the following functions:

(1) Transmission of an alarm signal to the fire department.

(2) Visual indication of the device operated on the control panel (FACP/MNCP), LCD, LED Display unit (VDU), and on the graphic annunciator. Indication on the graphic annunciator shall be by floor, zone or circuit, and type of device.

(3) Continuous actuation of all alarm notification appliances.

(4) Recording of the event via electronically in the history log of the fire control system unit.

(5) Release of doors held open by electromagnetic devices.

(6) Operation of the smoke control system.

(7) Release of power to electric locks (delayed egress locks) on doors that are part of the means of egress.

~~(8) Operation of a smoke sensor in an elevator lobby or other location associated with the automatic recall of elevators, shall recall the elevators in addition to other requirements of this paragraph.~~

(~~9~~8) Operation of a duct smoke sensor shall shut down the appropriate air handler in accordance with NFPA 90A in addition to other requirements of this paragraph and as allowed by NFPA 72.

(~~12~~9) Operation of an interface, that operates vibrating pagers worn by hearing-impaired occupants.

p. A supervisory signal shall automatically initiate the following functions:

(1) Visual indication of the device operated on the FACP, and on the graphic annunciator, and sound the audible alarm at the respective panel.

(2) Transmission of a supervisory signal to the fire department.

(3) Recording of the event electronically in the history log of the control unit.

q. A trouble condition shall automatically initiate the following functions:

(1) Visual indication of the system trouble on the FACP, and on the graphic annunciator, and sound the audible alarm at the respective panel.

(2) Transmission of a trouble signal to the fire department.

(3) Recording of the event in the history log of the control unit.

r. The maximum permissible elapsed time between the actuation of an

initiating device and its indication at the FACP is 10 seconds.

s. The maximum elapsed time between the occurrence of the trouble condition and its indication at the FACP is 200 seconds.

t. Activation of a LOC pushbutton shall activate the audible and visual alarms in the facility. The audible message shall be the one associated with the pushbutton activated.

2.4 SYSTEM MONITORING

2.4.1 Valves

Each valve affecting the proper operation of a fire protection system, including automatic sprinkler control valves, standpipe control valves, sprinkler service entrance valve, valves at fire pumps, isolating valves for pressure type waterflow or supervision switches, and valves at backflow preventers, whether supplied under this contract or existing, shall be electrically monitored to ensure its proper position. Provide each tamper switch with a separate address, unless they are within the same room, then a maximum of five can use the same address.

2.4.2 Independent Fire Detection System

Each existing independent smoke detection subsystem, kitchen fire extinguishing system, and releasing system (e.g. AFFF) shall be monitored both for the presence of an alarm condition and for a trouble condition. Provide each monitored condition with a separate address.

2.5 MASS NOTIFICATION SYSTEM FUNCTIONS

2.5.1 Notification Appliance Network

The audible notification appliance network consists of speakers located to provide intelligible instructions at all locations in the building. The Mass Notification System announcements shall take priority over all other audible announcements of the system including the output of the fire alarm system in a normal or alarm state. When a mass notification announcement is activated during a fire alarm, all fire alarm system functions shall continue in an alarm state except for the output signals of the fire alarm audible and visual notification appliances.

2.5.2 Strobes

Provide strobes to alert hearing-impaired occupants.

2.5.3 Text Displays

LED text displays (textural visible appliances) for hearing impaired occupants. The textual displays shall be programmable and shall display the same content of the voice message being played. The signs shall be able to provide a minimum of100 mm 4 inch high letters and be located in high traffic areas easily seen by building occupants. The system shall interface with the Programmable sign controller to activate the proper message.

2.5.4 Wide Area MNS

The Wide Area MNS system (if available) in the area of the building shall

not be activated by the in-building MNS.

2.5.5 Voice Notification

An autonomous voice notification control unit is used to monitor and control the notification appliance network and provide consoles for local operation. Using a console, personnel in the building can initiate delivery of pre-recorded voice messages, provide live voice messages and instructions, and initiate visual strobe and optional textual message notification appliances. The autonomous voice notification control unit will temporarily override audible fire alarm notification while delivering Mass Notification messages to ensure they are intelligible.

2.5.6 Installation-Wide Control

If an installation-wide control system for mass notification exists on the base, the autonomous control unit shall communicate with the central control unit of the installation-wide system. The autonomous control unit shall receive commands/messages from the central control unit and provide status information.

2.6 OVERVOLTAGE AND SURGE PROTECTION

2.6.1 Signaling Line Circuit Surge Protection

For systems having circuits located outdoors, communications equipment shall be protected against surges induced on any signaling line circuit and shall comply with the applicable requirements of IEEE C62.41.1 and IEEE C62.41.2. Cables and conductors, that serve as communications links, shall have surge protection circuits installed at each end that meet the following waveform(s):

a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Protection shall be provided at the equipment. Additional triple electrode gas surge protectors, rated for the application, shall be installed on each wireline circuit within 3 feet of the building cable entrance. Fuses shall not be used for surge protection.

2.6.2 Sensor Wiring Surge Protection

Digital and analog inputs and outputs shall be protected against surges induced by sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested with the following waveforms:

a. A 10 by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

b. An 8 by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Fuses shall not be used for surge protection.

2.7 ADDRESSABLE INTERFACE DEVICES

The initiating device being monitored shall be configured as a initiating device circuits. The system shall be capable of defining any module as an

alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling such as waterflow switches, valve supervisory switches, fire pump monitoring, independent smoke detection systems, relays for output function actuation, etc. The module shall be UL or FM listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled and is visible through the device cover plate. Pull stations with a monitor module in a common backbox are not required to have an LED.

2.8 ADDRESSABLE CONTROL MODULE

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL or FM listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Class "B" notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control model shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled and is visible through the device cover plate. Control Modules shall be located in environmental areas that reflect the conditions to which they were listed.

2.9 ISOLATION MODULES

Provide isolation modules to subdivide each signaling line circuit into groups of not more than 20 addressable devices between adjacent isolation modules.

2.10 SMOKE SENSORS

2.10.1 Photoelectric Smoke Sensors

Provide addressable photoelectric smoke sensors as follows:

a. Provide analog/addressable photoelectric smoke sensors utilizing the photoelectric light scattering principle for operation in accordance with UL 268. Smoke sensors shall be listed for use with the fire alarm control panel.

b. Provide self-restoring type sensors that do not require any readjustment after actuation at the FACP to restore them to normal operation. Sensors shall be UL listed as smoke-automatic fire sensors.

c. Components shall be rust and corrosion resistant. Vibration shall have no effect on the sensor's operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen shall not inhibit the movement of smoke particles into the chamber.

d. Provide twist lock bases with sounder that produces a minimum of 90 dBA at 10 feet for the sensors. The sensors shall maintain contact with

their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. The sensor shall have a visual indicator to show actuation.

e. The sensor address shall identify the particular unit, its location within the system, and its sensitivity setting. Sensors shall be of the low voltage type rated for use on a 24 VDC system.

f. An operator at the control panel, having a proper access level, shall have the capability to manually access the following information for each initiating device.

(1) Primary status

(2) Device type

(3) Present average value

(4) Present sensitivity selected

(5) Sensor range (normal, dirty, etc.)

2.10.2 Ionization Type Smoke Sensors

Provide addressable ionization type smoke sensors as follows:

a. Provide analog smoke sensors that operate on the ionization principle and are actuated by the presence of visible or invisible products of combustion. Smoke sensors shall be listed for use with the fire alarm control panel.

b. Provide self-restoring type sensors that do not require any readjustment after actuation at the FACP to restore them to normal operation. Sensors shall be UL or FM listed as smoke-automatic fire sensors.

c. Components shall be rust and corrosion resistant. Vibration shall have no effect on the sensor's operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen shall not inhibit the movement of smoke particles into the chamber.

d. Provide twist lock bases for the sensors. The sensors shall maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. The sensor shall have a visual indicator to show actuation.

e. The sensor address shall identify the particular unit, its location within the system, and its sensitivity setting. Sensors shall be of the low voltage type rated for use on a 24 VDC system.

f. An operator at the control panel, having a proper access level, shall have the capability to manually access the following information for each initiating device.

(1) Primary status

(2) Device type

(3) Present average value

(4) Present sensitivity selected

(5) Sensor range (normal, dirty, etc.)

(6) Sensitivity adjustments for smoke detectors.

2.10.3 Projected Beam Smoke Detectors

Detectors shall be designed for detection of abnormal smoke densities. Detectors shall consist of combined transmitter and receiver unit. The transmitter unit shall emit an infrared beam to the receiver unit . When the signal at the receiver falls below a preset sensitivity, the detector shall initiate an alarm. The receiver shall contain an LED that is powered upon an alarm condition. Long-term changes to the received signal caused by environmental variations shall be automatically compensated. Detectors shall incorporate features to assure that they are operational; a trouble signal shall be initiated if the beam is obstructed, the limits of the compensation circuit are reached, or the housing cover is removed. Detectors shall have multiple sensitivity settings in order to meet UL listings for the different distances covered by the beam. In the event of beam interference for more than three seconds a trouble alarm shall be transmitted.

2.10.4 Duct Smoke Sensors

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. (It is not permitted to cut the duct insulation to install the duct detector directly on the duct). Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 500 and 4000 fpm. Detectors shall be powered from the fire alarm panel.

a. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel.

b. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Remote indicators shall be provided where required by NFPA 72 and these shall be provided with test and reset switches.

c. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall provide for control of auxiliary contacts that provide control, interlock, and shutdown functions specified in Section 23 09 23 to LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS. Auxiliary contacts provide for this function shall be located within 3 feet of the controlled circuit or appliance. The detectors shall be supplied by the fire alarm system manufacturer to ensure

complete system compatibility.

2.10.5 Smoke Sensor Testing

Smoke sensors shall be tested in accordance with NFPA 72 and manufacturer's recommended calibrated test method. Submit smoke sensor testing procedures for approval. In addition to the NFPA 72 requirements, smoke detector sensitivity shall be tested during the preliminary tests.

2.11 HEAT DETECTORS

2.11.1 Heat Detectors

Heat detectors shall be designed for detection of fire by combination fixed temperature and rate-of-rise principle. The alarm condition shall be determined by comparing sensor valve with the stored values. Heat detector spacing shall be rated in accordance with UL 521. Detectors located in areas subject to moisture, exterior atmospheric conditions, or hazardous locations as defined by NFPA 70, shall be types approved for such locations.

2.11.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors shall be designed for semi-flush outlet box mounting and supported independently of wiring connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature actuation, the detector shall have a permanent external indication that is readily visible. Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes shall operate on fixed temperature principle only. The UL 521 test rating for the fixed temperature portion shall be 135 degrees F. The UL 521 test rating for the Rate-of-Rise detectors shall be rated for 50 by 50 feet.

2.11.1.2 Rate Compensating Detectors

Detectors shall be flush mounted horizontal type, with outlet box supported independently of wiring connections. Detectors shall be hermetically sealed and automatically resetting. Rate Compensated detectors shall be rated for 50 by 50 feet.

2.11.1.3 Fixed Temperature Detectors

Detectors shall be designed for semi-flush outlet box mounting and supported independently of wiring connections. Detectors shall be designed to detect high heat. The detectors shall have a specific temperature setting of 135 degrees F. The UL 521 test rating for the fixed temperature detectors shall be rated for 50 by 50 feet.

2.11.2 Self-Test Routines

Automatic self-test routines shall be performed on each sensor that will functionally check sensor sensitivity electronics and ensure the accuracy of the value being transmitted. Any sensor that fails this test shall indicate a trouble condition with the sensor location at the control panel.

2.11.3 Operator Access

An operator at the control panel, having the proper access level, shall have the capability to manually access the following information for each heat sensor:

a. Primary status

b. Device type

c. Present average value

d. Sensor range (NORMAL, DIRTY, ETC)

2.11.4 Operator Control

An operator at the control panel, having the proper access level, shall have the capability to manually control the following information for each heat sensor:

a. Alarm detection sensitivity values

b. Enable or disable the point/device

c. Control sensors relay driver output

2.12 MULTI SENSOR DETECTORS

Multi-sensor detectors shall contain , photoelectric smoke sensor, carbon monoxide sensor, elements in a single housing. Each detection sensor shall be listed to initiate a fire alarm condition.

2.13 MULTI CRITERIA DETECTORS

Multi-criteria detectors shall contain, photoelectric smoke sensor, carbon monoxide sensor, elements in a single housing. Only one detection sensor shall be listed to initiate a fire alarm condition. The others shall initiate a trouble alarm.

2.14 ELECTRIC POWER

2.14.1 Primary Power

Power shall be 120 VAC service for the FMCP from the AC service to the building in accordance with NFPA 72.

2.15 SECONDARY POWER SUPPLY

Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.

2.15.1 Batteries

Provide sealed, maintenance-free, sealed lead acid batteries as the source for emergency power to the FMCP. Batteries shall contain suspended electrolyte. The battery system shall be maintained in a fully charged condition by means of a solid state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power.

2.15.1.1 Capacity

Battery size shall be the greater of the following two capacities.

a. Sufficient capacity to operate the fire alarm system under supervisory and trouble conditions, including audible trouble signal devices for 24 hours and audible and visual signal devices under alarm conditions for an additional 15 minutes.

b. Sufficient capacity to operate the mass notification for 60 minutes after loss of AC power.

2.15.1.2 Battery Power Calculations

a. Verify that battery capacity exceeds supervisory and alarm power requirements.

(1) Substantiate the battery calculations for alarm, alert, and supervisory power requirements. Include ampere-hour requirements for each system component and each panel component, and compliance with UL 864.

(2) Provide complete battery calculations for both the alarm, alert, and supervisory power requirements. Submit ampere-hour requirements for each system component with the calculations.

(3) A voltage drop calculation to indicate that sufficient voltage is available for proper operation of the system and all components, at the minimum rated voltage of the system operating on batteries.

b. For battery calculations use the following assumptions: Assume a starting voltage of 24 VDC for starting the calculations to size the batteries. Calculate the required Amp-Hours for the specified standby time, and then calculate the required Amp-Hours for the specified alarm time. Calculate the nominal battery voltage after operation on batteries for the specified time period. Using this voltage perform a voltage drop calculation for circuit containing device and/or appliances remote from the power sources.

2.15.2 Battery Chargers

Provide a solid state, fully automatic, variable charging rate battery charger. The charger shall be capable of providing 120 percent of the connected system load and shall maintain the batteries at full charge. In the event the batteries are fully discharged (20.4 Volts dc), the charger shall recharge the batteries back to 95 percent of full charge within 48 hours after a single discharge cycle as described in paragraph CAPACITY above. Provide pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided.

2.16 FIRE ALARM CONTROL UNIT AND MASS NOTIFICATION CONTROL UNIT (FMCP)

Provide a complete control panel fully enclosed in a lockable steel cabinet as specified herein. Operations required for testing or for normal care and maintenance of the systems shall be performed from the front of the enclosure. If more than a single unit is required at a location to form a complete control panel, the unit cabinets shall match exactly.

a. Each control unit shall provide power, supervision, control, and logic for the entire system, utilizing solid state, modular components, internally mounted and arranged for easy access. Each control unit shall be suitable for operation on a 120 volt, 60 hertz, normal building power supply. Provide each panel with supervisory functions for power failure, internal component placement, and operation.

b. Visual indication of alarm, supervisory, or trouble initiation on the fire alarm control panel shall be by liquid crystal display or similar means with a minimum of 80 characters. The mass notification control unit shall have the capability of temporarily deactivate the fire alarm audible notification appliances while delivering voice messages.

c. Provide secure operator console for initiating recorded messages, strobes and displays; and for delivering live voice messages. Provide capacity for at least eight pre-recorded messages. Provide the ability to automatically repeat pre-recorded messages. Provide a secure microphone for delivering live messages. Provide adequate discrete outputs to temporarily deactivate fire alarm audible notification, and initiate/synchronize strobes. Provide a complete set of self-diagnostics for controller and appliance network. Provide local diagnostic information display and local diagnostic information and system event log file.

2.16.1 Cabinet

Install control panel components in cabinets large enough to accommodate all components and also to allow ample gutter space for interconnection of panels as well as field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall say "Fire Alarm and Mass Notification Control Panel" and shall not be less than 1 inch high. Provide prominent rigid plastic or metal identification plates for lamps, circuits, meters, fuses, and switches. The cabinet shall be provided in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.

2.16.2 Control Modules

Provide power and control modules to perform all functions of the FACP. Provide audible signals to indicate any alarm, supervisory, or trouble condition. The alarm signals shall be different from the trouble signal. Connect circuit conductors entering or leaving the panel to screw-type terminals with each terminal marked for identification. Locate diodes and resistors, if any, on screw terminals in the FACP. Circuits operating at 24 VDC shall not operate at less than the UL listed voltage at the sensor or appliance connected. Circuits operating at any other voltage shall not have a voltage drop exceeding 10 percent of nominal voltage

2.16.3 Silencing Switches

2.16.3.1 Alarm Silencing Switch

Provide an alarm silencing switch at the FMCP that shall silence the audible and visual. This switch shall be overridden upon activation of a subsequent alarm.

2.16.3.2 Supervisory/Trouble Silencing Switch

Provide supervisory and trouble silencing switch that shall silence the audible trouble and supervisory signal, but not extinguish the visual indicator. This switch shall be overridden upon activation of a subsequent alarm, supervision, or trouble condition. Audible trouble indication must resound automatically every 24 hours after the silencing feature has been operated.

2.16.4 Non-Interfering

Power and supervise each circuit such that a signal from one device does not prevent the receipt of signals from any other device. Circuits shall be manually reset by switch from the FACP after the initiating device or devices have been restored to normal.

2.16.5 Audible Notification System

The Audible Notification System shall comply with the requirements of NFPA 72 for Emergency Voice/Alarm Communications System requirements ISO 7240-16, IEC 60268-16, except as specified herein. The system shall be a one-way multi-channel voice notification system incorporating user selectability of a minimum eight distinct sounds for tone signaling, and the incorporation of a voice module for delivery of prerecorded messages. Audible appliances shall produce a temporal code 3 tone for three cycles followed by a voice message that is repeated until the control panel is reset or silenced. Automatic messages shall be broadcast through speakers throughout the building/facility but not in stairs or elevator cabs. A live voice message shall override the automatic audible output through use of a microphone input at the control panel or the LOC.

a. When using the microphone, live messages shall be broadcast throughout a selected floor or floors or all call The system shall be capable of operating all speakers at the same time. The microprocessor shall actively interrogate circuitry, field wiring, and digital coding necessary for the immediate and accurate rebroadcasting of the stored voice data into the appropriate amplifier input. Loss of operating power, supervisory power, or any other malfunction that could render the digitalized voice module inoperative shall automatically cause the code 3 temporal tone to take over all functions assigned to the failed unit in the event an alarm is activated.

b. The Mass Notification functions shall override the manual or automatic fire alarm notification or Public Address (PA) functions. Other fire alarm functions including transmission of a signal(s) to the fire department shall remain operational. The system shall have the capability of utilizing LOC with redundant controls of the notification system control panel. Notification Appliance Circuits (NAC) shall be provided for the activation of strobe appliances. The activation of the NAC Circuits shall follow the operation of the speaker NAC circuits. Audio output shall be selectable for line level. Amplifier outputs shall be not greater than 100 watts RMS output. The strobe NAC Circuits shall provide at least 2 amps of 24 VDC power to operate strobes and have the ability to synchronize all strobes. A hand held microphone shall be provided and, upon activation, shall take priority over any tone signal, recorded message or PA microphone operation in progress, while maintaining the strobe NAC Circuits activation.

2.16.5.1 Outputs and Operational Modules

All outputs and operational modules shall be fully supervised with on-board diagnostics and trouble reporting circuits. Provide form "C" contacts for system alarm and trouble conditions. Provide circuits for operation of auxiliary appliance during trouble conditions. During a Mass Notification event the panel shall not generate nor cause any trouble alarms to be generated with the Fire Alarm system.

2.16.5.2 Mass Notification

a. Mass Notification functions shall take precedence over all other function performed by the Audible Notification System. Messages shall utilize a male voice and shall be similar to the following:

(1) 1000 Hz tones (as required in 18.4.2.1 of NFPA 72)

(2) "May I have your attention please. May I have your attention please. An fire emergency has been reported in the building. Please leave the building by the nearest exit or exit stairway. Do not use the elevators." (Provide a 2 second pause.) "May I have your attention please, (repeat the message)."

(3) "May I have your attention please. May I have your attention please. Severe thunderstorm warning. A severe thunderstorm warning has been issued.: " (Provide a 2 second pause.) (repeat the message)

(4) "May I have your attention please. May I have your attention please. A National security warning has been issued. Please go inside and tune to your local television station or radio station. Remain calm."" (Provide a 2 second pause.) (repeat the message)

(5) "May I have your attention please. May I have your attention please. This is an emergency evacuation order. Remain calm. Follow the emergency officials. Remain calm."" (Provide a 2 second pause.) (repeat the message)

(6) "May I have your attention please. May I have your attention please. This is a gate closure advisory. Standby for a gate closure announcement."" (Provide a 2 second pause.) (repeat the message)

(7) "May I have your attention please. May I have your attention please. A Bomb Threat has been issued for this facility. Please evacute. Remain Calm."" (Provide a 2 second pause.) (repeat the message)

(8) "May I have your attention please. May I have your attention please. An all clear to the previous alert has been issued."" (Provide a 2 second pause.) (repeat the message)

b. Include ALL installation specific message in this section.

c. The LOC shall incorporate a Push-To-Talk (PTT) microphone, redundant controls and system status indicators of/for the system. The unit shall incorporate microphone override of any tone generation or prerecorded messages. The unit shall be fully supervised from the control panel. The housing shall contain a latch (not lock).

d. Auxiliary Input Module shall be designed to be an outboard expansion module to either expand the number of optional LOC's, or allow a telephone interface.

e. LOC shall incorporate a Push-To-Talk (PTT) microphone, and controls to allow Public Address paging in the facility. The Public Address paging function shall not override any alarm or notification functions and shall be disabled by such signals. The microphone shall be handheld style. All wiring to the LOC shall be supervised in accordance with UFC 4-021-01. Systems that require field modification or are not supervised for multiple LOC's shall not be approved.

f. When an installation has more than one LOC, the LOC's shall be programmed to allow only one LOC to be available for page or messaging at a time. Once one LOC becomes active, all other LOC's will have an indication that the system is busy (Amber Busy Light)and cannot be used at that time. This is to avoid two messages being given at the same time. Also, it must be possible to override or lockout the LOC's from the Master Command Panel (in accordance with NFPA 72.)

2.16.6 Memory

Provide each control unit with non-volatile memory and logic for all functions. The use of long life batteries, capacitors, or other age-dependent devices shall not be considered as equal to non-volatile processors, PROMS, or EPROMS.

2.16.7 Field Programmability

Provide control units and control panels that are fully field programmable for control, initiation, notification, supervisory, and trouble functions of both input and output. The system program configuration shall be menu driven. System changes shall be password protected and shall be accomplished using personal computer based equipment. Any proprietary equipment and proprietary software needed by qualified technicians to implement future changes to the fire alarm system shall be provided as part of this contract.

2.16.8 Input/Output Modifications

The FMCP shall contain features that allow the bypassing of input devices from the system or the modification of system outputs. These control features shall consist of a panel mounted keypad. Any bypass or modification to the system shall indicate a trouble condition on the FMCP.

2.16.9 Resetting

Provide the necessary controls to prevent the resetting of any alarm, supervisory, or trouble signal while the alarm, supervisory or trouble condition on the system still exists.

2.16.10 Instructions

Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the FACP. The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all

conditions, normal, alarm, supervisory, and trouble. The instructions shall be approved by the Contracting Officer before being posted.

2.16.11 Walk Test

The FACP shall have a walk test feature. When using this feature, operation of initiating devices shall result in limited system outputs, so that the notification appliances operate for only a few seconds and the event is indicated on the system printer, but no other outputs occur.

2.16.12 History Logging

In addition to the required printer output, the control panel shall have the ability to store a minimum of 400 events in a log. These events shall be stored in a battery-protected memory and shall remain in the memory until the memory is downloaded or cleared manually. Resetting of the control panel shall not clear the memory.

2.16.13 Remote LCD Text Display

An LCD text display shall be provided at locations as shown on the drawings. The size shall not exceed 16 inches length by 3 inches deep with a height necessary to meet the requirements of Chapter 24 of NFPA 72). The text display shall as a minimum meet the following requirements:

a. Two lines of information for high priority messaging.

b. Minimum of 20 characters per line (40 total) displayed.

c. Text shall be no less than height requirements in Table 24.4.2.20.14.5 of NFPA 72 and color/contrast requirements of 24.4.2.20 of NFPA 72.

d. 32K character memory.

e. Display shall be wall or ceiling mounted.

f. Mounting brackets for a convenient wall/cubicle mount.

g. During non-emergency periods, display date and time.

h. All programming shall be accomplished from the Mass Notification network. No user programming shall be required.

An LCD text display shall be provided at locations as shown on the drawings. The LCD text display shall spell out the words "EVACUATE" and "ANNOUNCEMENT" and the remainder of the emergency instructions. The design of LCD text display shall be such that it cannot be read when not illuminated.

2.17 REMOTE FIRE ALARM/MASS NOTIFICATION CONTROL UNITS

Provide complete remote control units fully enclosed in a lockable steel enclosure as specified herein. Operations required for testing or for normal care and maintenance of the control units shall be performed from the front of the enclosure. If more than a single unit is required at a location to form a complete control panel, the unit enclosures shall match exactly. Each control unit shall provide power, supervision, control, and logic for its portion of the entire system, utilizing solid state, modular components, internally mounted and arranged for easy access. Each control

unit shall be suitable for operation on a 120 volt, 60 hertz, normal building power supply. Provide each unit with supervisory functions for power failure, internal component placement, and operation.

2.17.1 Cabinet

Install remote control unit components in cabinets large enough to accommodate components and also to allow ample gutter space for interconnection of units as well as field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall be labeled "Remote Fire Alarm/Mass Notification Control Unit" and shall not be less than one inch high. Provide prominent rigid plastic or metal identification plates for lamps, circuits, meters, fuses, and switches. The cabinet shall be provided in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock (keyed the same as the FMCP), and surface mounting provisions.

2.17.2 Control Modules

Provide power and control modules to perform all functions of the remote control unit. Provide audible signals to indicate any alarm or trouble condition. The alarm signals shall be different from the trouble signal. Connect circuit conductors entering or leaving the panel to screw-type terminals with each terminal marked for identification. Locate diodes and relays, if any, on screw terminals in the remote control unit. Circuits shall not have a voltage drop exceeding 10 percent of nominal voltage. Circuits shall be arranged so that there is 25 percent spare capacity for any circuit.

2.17.3 Silencing Switches

Provide an alarm silencing switch at the remote control unit that shall silence the audible signal and extinguish the visual alarms. This switch shall be overridden upon activation of a subsequent alarm. Provide trouble and supervisory silencing switch that shall silence the audible trouble and supervisory signal, but not extinguish the visual indicator. This switch shall be overridden upon activation of a subsequent trouble or supervisory signal. Audible trouble indication must resound automatically every 24 hours after the silencing feature has been operated.

2.17.4 Non-Interfering

Power and supervise each circuit such that a signal from one device does not prevent the receipt of signals from any other device. Circuits shall be manually resettable by switch from the remote control unit after the initiating device or devices have been restored to normal.

2.17.5 Memory

Provide each control unit with non-volatile memory and logic for all functions. The use of long life batteries, capacitors, or other age-dependent devices shall not be considered as equal to non-volatile processors, PROMS, or EPROMS.

2.17.6 Field Programmability

Provide control units that are fully field programmable for control, initiating, supervisory, and trouble functions of both input and output. The system program configuration shall be menu driven. System changes

shall be password protected and shall be accomplished using personal computer based equipment. Any proprietary equipment and proprietary software needed by qualified technicians to implement future changes to the fire alarm system shall be provided as part of this contract.

2.17.7 Input/Output Modifications

Each remote control unit shall contain features that allow the elimination of input devices from the system or the modification of system outputs. Any such modifications shall indicate a trouble condition on the remote control unit, the FACP, and a printed output of the trouble condition.

2.17.8 Resetting

Provide the necessary controls to prevent the resetting of any alarm, supervisory, or trouble signal while the alarm, supervisory, or trouble condition on the system still exists.

2.17.9 Instructions

Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the remote fire alarm control unit. Install the frame in a conspicuous location observable from the remote fire alarm control unit. The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory, and trouble. The instructions shall be approved by the Contracting Officer before being posted.

2.17.10 Walk Test

Each remote control unit shall have a walk test feature. When using this feature, operation of initiating devices shall result in limited system outputs, so that the notification appliances operate for only a few seconds and the event is indicated on the system printer, but no other outputs occur.

2.17.11 History Logging

In addition to the required printer output, the control panel shall have the ability to store a minimum of 1000 events in a log. These events shall be stored in a battery-protected memory and shall remain in the memory until the memory is downloaded or cleared manually. Resetting of the control panel shall not clear the memory.

2.18 AMPLIFIERS, PREAMPLIFIERS, TONE GENERATORS

Any amplifiers, preamplifiers, tone generators, digitalized voice generators, and other hardware necessary for a complete, operational, textual audible circuit conforming to NFPA 72 shall be housed in a remote FMCP, terminal cabinet, or in the FMCP. Submit data to indicate that the amplifiers have sufficient capacity to simultaneously drive all notification speakers at the maximum rating plus 50 percent spare capacity. Annotate data for each circuit on the drawings.

2.18.1 Operation

The system shall automatically operate and control all building speakers

except those installed in the stairs and within elevator cabs. The speakers in the stairs and elevator cabs shall operate only when the microphone is used to deliver live messages.

2.18.2 Construction

Amplifiers shall utilize computer grade solid state components and shall be provided with output protection devices sufficient to protect the amplifier against any transient up to 10 times the highest rated voltage in the system.

2.18.3 Inputs

Equip each system with separate inputs for the tone generator, digitalized voice driver and panel mounted microphone . Microphone inputs shall be of the low impedance, balanced line type. Both microphone and tone generator input shall be operational on any amplifier.

2.18.4 Tone Generator

The tone generator shall be of the modular, plug-in type with securely attached labels to identify the component as a tone generator and to identify the specific tone it produces. The tone generator shall produce a code 3 temporal tone and shall be constantly repeated until interrupted by either the digitalized voice message, the microphone input, or the alarm silence mode as specified. The tone generator shall be single channel with an automatic backup generator per channel such that failure of the primary tone generator causes the backup generator to automatically take over the functions of the failed unit and also causes transfer of the common trouble relay.

2.18.5 Protection Circuits

Each amplifier shall be constantly supervised for any condition that could render the amplifier inoperable at its maximum output. Failure of any component shall cause automatic transfer to a designated backup amplifier, illumination of a visual "amplifier trouble" indicator on the control panel, appropriate logging of the condition on the system printer, and other actions for trouble conditions as specified.

2.19 ANNUNCIATOR

2.19.1 Annunciator Panel

Provide an annunciator that includes an LCD display. The display shall indicate the device in trouble/alarm or any supervisory device. Display the device name, address, and actual building location.

A building floor plan shall be provided mounted (behind plexiglass or similar protective material) at the annunciator location. The floor plan shall indicate all rooms by name and number including the locations of stairs and elevators. The floor plan shall show all devices and their programmed address to facilitate their physical location from the LCD display information.

2.19.2 Programming

Where programming for the operation of the annunciator is accomplished by a separate software program than the software for the FMCP, the software

program shall not require reprogramming after loss of power. The software shall be reprogrammable in the field.

2.20 MANUAL STATIONS

Provide metal or plastic, semi-flush mounted, single action, addressable manual stations, that are not subject to operation by jarring or vibration. Stations shall be equipped with screw terminals for each conductor. Stations that require the replacement of any portion of the device after activation are not permitted. Stations shall be finished in fire-engine red with molded raised lettering operating instructions of contrasting color. The use of a key or wrench shall be required to reset the station. Manual stations shall be mounted at 42 inches. Stations shall have a separate screw terminal for each conductor.

2.21 NOTIFICATION APPLIANCES

2.21.1 Fire Alarm/Mass Notification Speakers

Audible appliances shall conform to the applicable requirements of UL 464. Appliances shall be connected into notification appliance circuits. Surface mounted audible appliances shall be painted red. Recessed audible appliances shall be installed with a grill that is painted red.

a. Speakers shall conform to the applicable requirements of UL 1480. Speakers shall have six different sound output levels and operate with audio line input levels of 70.7 VRMs and 25 VRMs, by means of selectable tap settings. Tap settings shall include taps of 1/8, 1/4, 1/2, 1, and 2 watt. Speakers shall incorporate a high efficiency speaker for maximum output at minimum power across a frequency range of 150 Hz to 10,000 Hz, and shall have a sealed back construction. Speakers shall be capable of installation on standard 4 inch square electrical boxes. Where speakers and strobes are provided in the same location, they may be combined into a single wall mounted unit. All inputs shall be polarized for compatibility with standard reverse polarity supervision of circuit wiring via the FMCP.

b. Provide speaker mounting plates constructed of cold rolled steel having a minimum thickness of 16 gauge or molded high impact plastic and equipped with mounting holes and other openings as needed for a complete installation. Fabrication marks and holes shall be ground and finished to provide a smooth and neat appearance for each plate. Each plate shall be primed and painted.

c. Speakers shall utilize screw terminals for termination of all field wiring.

2.21.2 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and conform to the Architectural Barriers Act (ABA). Colored lens, such as amber, shall comply with UL 1638. The manufacturer shall have the color lens tested to the full UL 1971 polar plotting criteria, voltage drop, and temperature rise as stated in 1971. Fire Alarm Notification Appliances shall have clear high intensity optic lens, xenon flash tubes, and be marked "Fire" in red letters.Fire Alarm/Mass Notification Appliances shall have amber high intensity optic lens, xenon flash tubes, and output white light and be marked "ALERT" in red letters. The light pattern shall be disbursed so that it is visible above and below

the strobe and from a 90 degree angle on both sides of the strobe. Strobe flash rate shall be 1 flash per second and a minimum of 30 candela (actual output after derating for tinted lens) based on the UL 1971 test. Strobe shall be semi-flush mounted. Where more than two appliances are located in the same room or corridor or field of view, provide synchronized operation. Devices shall use screw terminals for all field wiring.

2.22 ENVIRONMENTAL ENCLOSURES OR GUARDS

Environmental enclosures shall be provided to permit Fire Alarm or Mass Notification components to be used in areas that exceed the environmental limits of the listing. The enclosure shall be listed for the device or appliance as either a manufactured part number or as a listed compatible accessory for the UL category that the component is currently listed. Guards required to deter mechanical damage shall be either a listed manufactured part or a listed accessory for the category of the initiating device or notification appliance.

2.23 INTERFACE TO THE BASE WIDE MASS NOTIFICATION NETWORK

2.23.1 Fiber Optic

The fiber optic transceiver shall be fully compatible with EIA standards for RS-232, RS-422 and RS-485 at data rates from 0 (DC) to 2.1 mbps (200 kbps for RS-232) in the low speed mode or from 10 kbps to 10 mbps in the high-speed mode. The fiber optic transceiver shall be capable of simplex or full duplex asynchronous transmissions in both point-to-point systems and drop-and-repeat data networks. The fiber optic transceiver shall be user configurable for the protocol, speed and mode of operation required. The fiber optic transceiver shall be installed as a stand-alone unit. The fiber optic transceiver shall operate on Single-mode fiber optic cable. The fiber optic transceiver shall be supplied with ST or FCPC type optical connectors. Cabling: as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.23.2 Radio

The radio transceiver shall be bi-direction and meet all the requirements of paragraph, RADIO TRANSMITTER AND INTERFACE PANELS as specified in this Specification Section. The transceiver utilized in the Mass Notification System shall be capable of the following:

a. Communication with the Central Control/Monitoring System to provide supervision of communication link and status changes are reported by automatic and manual poll/reply/acknowledge routines.

b. All monitored points/status changes are transmitted immediately and at programmed intervals until acknowledged by the Central Control/Monitoring System.

c. Each transceiver shall transmits a unique identity code as part of all messages; the code is set by the user at the transceiver.

2.23.2.1 Radio Frequency Communications

Use of radio frequency-type communications systems shall comply with National Telecommunications and Information Administration (NTIA) requirements.

2.23.2.2 Licensed Radio Frequency Systems

An approved DD Form 1494 for the system is required prior to operation.

2.23.3 Telephone

A modem shall be provide for communication with the Central Control/Monitoring System. The modem shall be 56k, compatible with data mode V.90, utilizing Hayes compatible command codes. The modem shall be capable of Auto dialing a preset number based on preprogrammed events. The modem shall auto answer and provide a secure password protection system. Cabling: as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.23.4 Secure Radio System

2.23.4.1 Communications Network

The communications network provides two-way signals between central control units and autonomous control units (in individual building systems), and should include redundant (primary and backup) communication links. The system shall incorporate technology to prevent easy interruption of the radio traffic for MNS Alerting.

2.23.4.2 Radio Frequency Communications

Use of radio frequency-type communications systems shall comply with National Telecommunications and Information Administration (NTIA) requirements. The systems shall be designed to minimize the potential for interference, jamming, eavesdropping, and spoofing.

2.23.4.3 Licensed Radio Frequency Systems

An approved DD Form 1494 for the system is required prior to operation.

2.24 AUTOMATIC FIRE TRANSMITTERS

2.24.1 Signals to Be Transmitted to the Base Receiving Station

The following signals shall be sent to the base receiving station:

a. Sprinkler water flow

b. Duct smoke detectors

c. Sprinkler valve supervision

2.25 WIRING

Provide wiring materials under this section as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM with the additions and modifications specified herein. NFPA 70 accepted fire alarm cables that do not require the use of raceways except as modified herein are permitted.

2.25.1 Alarm Wiring

The SLC wiring shall be solid copper cable in accordance with the manufacturers requirements. Copper signaling line circuits and initiating device circuit field wiring shall be No. 18 AWG size twisted and shielded

solid conductors at a minimum. Visual notification appliance circuit conductors, that contain audible alarm appliances, shall be solid copper No. 14 AWG size conductors at a minimum. Speaker circuits shall be copper No. 16 AWG size twisted and shielded conductors at a minimum. Wire size shall be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC shall not operate at less than the UL listed voltages for the sensors and/or appliances. Power wiring, operating at 120 VAC minimum, shall be a minimum No. 12 AWG solid copper having similar insulation. Acceptable power-limited cables are FPL, FPLR or FPLP as appropriate with red colored covering. Nonpower-limited cables shall comply with NFPA 70.

PART 3 EXECUTION

3.1 INSTALLATION OF FIRE ALARM INITIATING DEVICES AND NOTIFICATION APPLIANCES

3.1.1 FMCP

Locate the FMCP where indicated on the drawings. Recess the enclosure with the top of the cabinet 6 feet above the finished floor or center the cabinet at 5 feet, whichever is lower. Conductor terminations shall be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection shall be permanently mounted in the FMCP.

3.1.2 Manual Stations:

Locate manual stations as required by NFPA 72 and as indicated. Mount stations so that their operating handles are 4 feet above the finished floor. Mount stations so they are located no farther than 5 feet from the exit door they serve, measured horizontally.

3.1.3 Notification Appliance Devices

Locate notification appliance devices as required by NFPA 72. Mount assemblies on walls as required by NFPA 72 and to meet the intelligibility requirements. Ceiling mounted speakers shall conform to NFPA 72.

3.1.4 Smoke and Heat Sensors

Locate sensors as required by NFPA 72 and their listings on a 4 inch mounting box. Locate smoke and heat sensors on the ceiling. Install heat sensors not less than 4 inches from a side wall to the near edge. Heat sensors located on the wall shall have the top of the sensor at least 4 inches below the ceiling, but not more than 12 inches below the ceiling. Smoke sensors are permitted to be on the wall no lower than 12 inches from the ceiling with no minimum distance from the ceiling. In raised floor spaces, install the smoke sensors to protect 225 square feet per sensor. Install smoke sensors no closer than 5 feet from air handling supply outlets.

3.1.5 Annunciator

Locate the annunciator as shown on the drawings. Surface mount the panel, with the top of the panel 6 feet above the finished floor or center the panel at 5 feet, whichever is lower.

3.1.6 Water Flow Detectors and Tamper Switches

Connect to water flow detectors and tamper switches.

3.1.7 Firefighter Telephones

Locate wall mounted in each stair at each floor landing, in each elevator lobby, and in each elevator cab 4 feet above the finished floor.

3.1.8 Local Operating Console (LOC)

Locate the LOC as required by NFPA 72 and as indicated. Mount the console so that the top message button is no higher than 44 inches above the floor.

3.2 SYSTEM FIELD WIRING

3.2.1 Wiring within Cabinets, Enclosures, and Boxes

Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of any box, enclosure, or cabinet. Conductors that are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting, or junction box shall be connected to screw-type terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. The use of wire nuts or similar devices is prohibited. Conform wiring to NFPA 70.

Indicate the following in the wiring diagrams.

a. Point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems that are supervised or controlled by the system. Diagrams shall show connections from field devices to the FACP and remote fire alarm control units, initiating circuits, switches, relays and terminals.

b. Complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring. Include floor plans showing the locations of devices and equipment.

3.2.2 Terminal Cabinets

Provide a terminal cabinet at the base of any circuit riser, on each floor at each riser, and where indicated on the drawings. Terminal size shall be appropriate for the size of the wiring to be connected. Conductor terminations shall be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection shall be permanently mounted in the terminal cabinet. Minimum size is 8 inches by 8 inches. Only screw-type terminals are permitted.

3.2.3 Alarm Wiring

Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Provide all wiring in electrical metallic conduit. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 6 foot length shall be permitted in initiating device or notification appliance circuits. Run conduit or tubing (rigid, IMC, EMT, FMC, etc. as permitted by NFPA 72 and NFPA 70) concealed unless specifically indicated otherwise.

3.2.4 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets, FMCP, and remote FMCP and the LOC shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet, FMCP, and remote FMCP shall contain a laminated drawing that indicates each conductor, its label, circuit, and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

~~3.3 DISCONNECTION AND REMOVAL OF EXISTING SYSTEM~~

~~Maintain existing fire alarm equipment fully operational until the new equipment has been tested and accepted by the Contracting Officer. As new equipment is installed, label it "NOT IN SERVICE" until the new equipment is accepted. Once the new system is completed, tested, and accepted by the Government, it shall be placed in service and connected to the station fire alarm system. Remove tags from new equipment and tag the existing equipment "NOT IN SERVICE" until removed from the building.~~

~~a. After acceptance of the new system by the Contracting Officer, remove existing equipment not connected to the new system, remove unused exposed conduit, and restore damaged surfaces. Remove the material from the site and dispose.~~

~~b. Disconnect and remove the existing fire alarm and smoke detection systems where indicated and elsewhere in the specification.~~

~~c. Control panels and fire alarm devices and appliances disconnected and removed shall be turned over to the Contracting Officer.~~

~~d. Properly dispose of fire alarm outlet and junction boxes, wiring, conduit, supports, and other such items.~~

~~3.4 CONNECTION OF NEW SYSTEM~~

~~The following new system connections shall be made during the last phase of construction, at the beginning of the preliminary tests. New system connections shall include:~~

~~a. Connection of new control modules to existing magnetically held smoke door (hold open) devices.~~

~~b. Connection of new elevator recall smoke sensors to existing wiring and conduit.~~

~~c. Connection of new system transmitter to existing base fire reporting system.~~

~~Once these connections are made, system shall be left energized and new audio/visual devices deactivated. Report immediately to the Contracting Officer, coordination and field problems resulting from the connection of the above components.~~

3.3 FIRESTOPPING

Provide firestopping for holes at conduit penetrations through floor slabs,

fire rated walls, partitions with fire rated doors, corridor walls, and vertical service shafts in accordance with Section 07 84 00 FIRESTOPPING.

3.4 PAINTING

Paint exposed electrical, fire alarm conduit, and surface metal raceway to match adjacent finishes in exposed areas. Paint junction boxes red in unfinished areas and conduits and surface metal raceways shall be painted with a 1-inch wide red band every 10 feet in unfinished areas.. Painting shall comply with Section 09 90 00 PAINTS AND COATINGS.

3.5 FIELD QUALITY CONTROL

3.5.1 Testing Procedures

Submit detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 4 Fire Alarm Technician, and signed by representative of the installing company, for the fire detection and alarm system 60 days prior to performing system tests. Detailed test procedures shall list all components of the installed system such as initiating devices and circuits, notification appliances and circuits, signaling line devices and circuits, control devices/equipment, batteries, transmitting and receiving equipment, power sources/supply, annunciators, special hazard equipment, emergency communication equipment, interface equipment, Guard's Tour equipment, and transient (surge) suppressors. Test procedures shall include sequence of testing, time estimate for each test, and sample test data forms. The test data forms shall be in a check-off format (pass/fail with space to add applicable test data; similar to the forma in NFPA 72) and shall be used for the preliminary testing and the acceptance testing. The test data forms shall record the test results and shall:

a. Identify the NFPA Class of all Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), Voice Notification System Circuits (NAC Audio), and Signaling Line Circuits (SLC).

b. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how this test shall be performed.

c. Identify each component and circuit as to type, location within the facility, and unique identity within the installed system. Provide necessary floor plan sheets showing each component location, test location, and alphanumeric identity.

d. Identify all test equipment and personnel required to perform each test (including equipment necessary for testing smoke detectors using real smoke).

e. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

3.5.2 Tests Stages

3.5.2.1 Preliminary Testing

Conduct preliminary tests to ensure that devices and circuits are functioning properly. Tests shall meet the requirements of paragraph

entitled "Minimum System Tests." After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that panel functions were tested and operated properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

3.5.2.2 Request for Formal Inspection and Tests

When tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Contracting Offices Designated Representative (COR).

3.5.2.3 Final Testing

Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 15 calendar days prior to the test date. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. Furnish instruments and personnel required for the tests. A final acceptance test will not be scheduled until the following are provided at the job site:

a. The systems manufacturer's technical representative

b. Marked-up red line drawings of the system as actually installed

c. Megger test results

d. Loop resistance test results

e. Complete program printout including input/output addresses

The final tests will be witnessed by the Contracting Offices Designated Representative (COR). At this time, any and all required tests shall be repeated at their discretion.

3.5.2.4 System Acceptance

Following acceptance of the system, as-built drawings and O&M manuals shall be delivered to the Contracting Officer for review and acceptance. Submit six sets of detailed as-built drawings. The drawings shall show the system as installed, including deviations from both the project drawings and the approved shop drawings. These drawings shall be submitted within two weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings shall be provided at the time of, or prior to the final acceptance test.

a. Furnish one set of full size paper as-built drawings and schematics. The drawings shall be prepared on uniform sized mylar sheets not less than 30 by 42 inches with 8 by 4 inch title block similar to contract drawings. Furnish one set of CD or DVD discs containing software back-up and CAD based drawings in latest version of AutoCAD and DXF format of as-built drawings and schematics.

b. Include complete wiring diagrams showing connections between devices

and equipment, both factory and field wired.

c. Include a riser diagram and drawings showing the as-built location of devices and equipment.

3.5.3 Minimum System Tests

Test the system in accordance with the procedures outlined in NFPA 72, ISO 7240-16, IEC 60268-16. The required tests are as follows:

a. Megger Tests: After wiring has been installed, and prior to making any connections to panels or devices, wiring shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors with 300 volt rated insulation shall be tested at a minimum of 250 VDC. Conductors with 600 volt rated insulation shall be tested at a minimum of 500 VDC. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.

b. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.

c. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.

d. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.

e. Test each initiating device and notification appliance and circuit for proper operation and response at the control unit. Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors shall comply with the requirements of NFPA 72 except that, for item 12(e) (Supervision) in Table 14.4.2.2, disconnect at least 20 percent of devices. If there is a failure at these devices, then supervision shall be tested at each device.

f. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.

g. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.

h. Determine that the system is operable under trouble conditions as specified.

i. Visually inspect wiring.

j. Test the battery charger and batteries.

k. Verify that software control and data files have been entered or programmed into the FACP. Hard copy records of the software shall be provided to the Contracting Officer.

l. Verify that red-line drawings are accurate.

m. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.

n. Measure voltage readings for circuits to ensure that voltage drop is not excessive.

o. Disconnect the verification feature for smoke sensors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke sensors shall be conducted using real smoke or the use of canned smoke which is permitted.

p. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.

3.5.3.1 Intelligibility Tests

Intelligibility testing of the System shall be accomplished in accordance with NFPA 72 for Voice Evacuation Systems, IEC 60268-16, and ASA S3.2. Following are the specific requirements for intelligibility tests:

a. Intelligibility Requirements: Verify intelligibility by measurement after installation.

b. Ensure that a CIS value greater than the required minimum value is provided in each area where building occupants typically could be found. The minimum required value for CIS is .8.

c. Areas of the building provided with hard wall and ceiling surfaces (such as metal or concrete) that are found to cause excessive sound reflections may be permitted to have a CIS score less than the minimum required value if approved by the DOD installation, and if building occupants in these areas can determine that a voice signal is being broadcast and they must walk no more than 33 feet to find a location with at least the minimum required CIS value within the same area.

d. Areas of the building where occupants are not expected to be normally present are permitted to have a CIS score less than the minimum required value if personnel can determine that a voice signal is being broadcast and they must walk no more than 50 feet to a location with at least the minimum required CIS value within the same area.

e. Take measurements near the head level applicable for most personnel in the space under normal conditions (e.g., standing, sitting, sleeping, as appropriate).

f. The distance the occupant must walk to the location meeting the minimum required CIS value shall be measured on the floor or other walking surface as follows:

(1) Along the centerline of the natural path of travel, starting from any point subject to occupancy with less than the minimum required CIS value.

(2) Curving around any corners or obstructions, with a 12 inches clearance there from.

(3) Terminating directly below the location where the minimum required CIS value has been obtained.

Use commercially available test instrumentation to measure intelligibility as specified by ISO 7240-19 and ISO 7240-16 as applicable. Use the mean value of at least three readings to compute the intelligibility score at each test location.

3.6 INSTRUCTION OF GOVERNMENT EMPLOYEES

3.6.1 Instructor

Include in the project the services of an instructor, who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided. The instructor shall train the Government employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm and fire detection system. Each instructor shall be thoroughly familiar with all parts of this installation. The instructor shall be trained in operating theory as well as in practical O&M work. Submit the instructors information and qualifications including the training history.

3.6.2 Required Instruction Time

Provide 8 hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

3.6.2.1 Technical Training

Equipment manufacturer or a factory representative shall provide 1 days of on site Training shall allow for classroom instruction as well as individual hands on programming, troubleshooting and diagnostics exercises. Training shall occur within 6 months of system acceptance.

3.7 Technical Data and Computer Software

Provide, in manual format, lesson plans, operating instructions, maintenance procedures, and training data for the training courses. The operations training shall familiarize designated government personnel with proper operation of the installed system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

3.8 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

Submit 8 copies of the Operation and Maintenance Instructions, indexed and in booklet form. The Operation and Maintenance Instructions shall be a single volume or in separate volumes, and may be submitted as a Technical Data Package. Manuals shall be approved prior to training. The Interior Fire Alarm And Mass Notification System Operation and Maintenance Instructions shall include:

a. "Manufacturer Data Package 5" as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA.

b. Operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features.

c. Maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed.

d. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements.

e. Software delivered for this project shall be provided, on each type of CD/DVD media utilized.

f. Printouts of configuration settings for all devices.

g. Routine maintenance checklist. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all installed devices, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference. All data (devices, testing frequencies, etc.) shall comply with UFC 3-601-02.

3.9 EXTRA MATERIALS

3.9.1 Repair Service/Replacement Parts

Repair services and replacement parts for the system shall be available for a period of 10 years after the date of final acceptance of this work by the Contracting Officer. During guarantee period, the service technician shall be on-site within 24 hours after notification. All repairs shall be completed within 24 hours of arrival on-site.

3.9.2 Interchangeable Parts

Spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the Contracting Officer at the time of the final acceptance testing.

-- End of Section --

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DIVISION 31 - EARTHWORK

SECTION 31 00 00

EARTHWORK

08/08

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SECTION 31 00 00

EARTHWORK
08/08

PART 1 GENERAL

Attachments: Final Geotechnical Report (See Appendix A of the Solicitation)

1.1 MEASUREMENT PROCEDURES

1.2 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

[*Am-1]

c. ~~Ground water elevation was not determined at this location. .~~Ground water elevations indicated by the boring logs were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.

~~e~~d. ~~Site specific boring logs are not available.~~Material character is indicated by the boring logs.

e. Hard materials will **not** be encountered below existing surface elevations (See Boring Logs).

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2010) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 224	(2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

ASTM INTERNATIONAL (ASTM)

ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1140	(2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	(2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2167	(2008) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2937	(2010) Density of Soil in Place by the Drive-Cylinder Method
ASTM D422	(1963; R 2007; E 2014) Particle-Size Analysis of Soils
ASTM D4318	(2010; E 2014) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	(2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.4 DEFINITIONS

1.4.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, CL. Satisfactory materials for grading comprise stones less than 3 inches, except for fill material for pavements which comprise stones less than 1 inches in any dimension.

1.4.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.4.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D4318, ASTM C136, ASTM D422, and ASTM D1140.

1.4.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in AASHTO T 180.

[*Am-1]
1.4.5 1.5.6 Topsoil

Conform to the requirements of Section 32 92 19 SEEDING.

1.4.6 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 1_ inch in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

~~1.4.7 NOT USED~~

[*Am-1]
1.4.7 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.4.8 Unstable Material

Unstable materials are too wet to properly support the utility pipe, conduit, or appurtenant structure~~.~~ after processing, aeration, drying, and recompaction.

1.4.9 Select Granular Material

1.4.9.1 General Requirements

Select granular material consist of materials classified as GW, GP, SW, SP, by ASTM D2487 where indicated. The liquid limit of such material must not exceed 35 percent when tested in accordance with ASTM D4318. The plasticity index must not be greater than 12 percent when tested in accordance with ASTM D4318, and not more than 35 percent by weight may be finer than No. 200 sieve when tested in accordance with ASTM D1140.

1.4.10 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks 1/2 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, free the initial backfill material of stones larger than 1/2 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.4.11 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than 25 when tested in accordance with ASTM D4318.

[*Am-1]
1.5 ~~NOT USED~~SYSTEM DESCRIPTION

Subsurface soil boring logs are shown on the contract drawings. This data represents the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5.1 Classification of Excavation

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.5.1.1 Common Excavation

Include common excavation with the satisfactory removal and disposal of all materials not classified as rock excavation.

1.5.1.2 NOT USED

1.5.2 Blasting

Blasting will not be permitted.

1.5.3 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When

used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Shoring; G-DO
Dewatering Work Plan; G-DO

SD-03 Product Data

Utilization of Excavated Materials; G-AO

Opening of any Excavation or Borrow Pit
Shoulder Construction

SD-06 Test Reports

Testing

Borrow Site Testing

Within 24 hours of conclusion of physical tests, submit 3_ copies of test results, including calibration curves and results of calibration tests.

SD-07 Certificates

Testing

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFFSITE SOILS

Offsite borrow shall be visually free from contamination.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

Provide metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes	
Red	Electric
Orange	Telephone and Other Communications
Blue	Water Systems

Warning Tape Color Codes	
Green	Sewer Systems

2.2.1 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

PART 3 EXECUTION

[*Am-1]
3.1 3.1 STRIPPING OF TOPSOIL

Where indicated or directed, strip topsoil to a depth of 10 inches. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas if available. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from other approved areas selected by the Contractor as specified. If no designated disposal site is available, dispose surplus material outside the limits of Government controlled property.

3.2.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting

accurately to the cross sections, grades, and elevations shown. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum 4 feet from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or other hard foundation material of loose debris and cut to a firm, level, stepped, or serrated surface. Remove loose disintegrated rock and thin strata. Do not disturb the bottom of the excavation when concrete or masonry is to be placed in an excavated area. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.4 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. Do not permit French drains, sumps, ditches or trenches within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least 1 foot_ below the working level. Contractor is responsible for design and operation of dewatering system resulting in suitable, dry conditions to facilitate construction. Contractor shall submit dewatering plan along with all calculations and assumptions.

3.2.5 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation

manual. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore , cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in in accordance with 29 CFR 1926 and all applicable Corps or State safety regulations. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter, and do not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the Contractor. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Government.

3.2.5.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of 1/2 inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.2.5.2 Removal of Unyielding Material

Where overdepth is not indicated and unyielding material is encountered in the bottom of the trench, remove such material 6 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.5.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2.5.4 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Remove loose disintegrated rock and thin strata. Specify removal of unstable material. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.6 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven

equipment is not permitted within 2 feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.7 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement.

3.3 OPENING AND DRAINAGE OF EXCAVATION

Notify the Contracting Officer sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, excavation areas providing adequate drainage. Transport overburden and other spoil material to designated spoil areas or otherwise dispose of as directed. Ensure that excavation of any area, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.4 SHORING

3.4.1 General Requirements

Submit a Shoring and Sheeting plan for approval, if required by the nature of work, 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheeting as excavations are backfilled, in a manner to prevent caving.

3.5 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory and unsatisfactory and wasted materials as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.6 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed.

3.7 GROUND SURFACE PREPARATION

3.7.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 6 inches before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inches, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inches and compact it as specified for the adjacent fill.

3.7.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten cohesionless material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Cohesive materials shall be moisture-conditioned to within +/- 2% of optimum moisture content prior to compaction.

3.8 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas if available, else dispose of outside the limits of Government-controlled land. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Submit procedure and location for disposal of unused satisfactory material. Do not waste any satisfactory excavated material without specific written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas, if available, as directed, else dispose of outside the limits of Government-controlled land. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.9 BURIED TAPE

3.9.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.10 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, and compact to

at least 92 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials, to prevent wedging action or eccentric loading upon or against the structure. Prepare ground surface on which backfill is to be placed and provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.10.1 Trench Backfill

Backfill trenches to the grade shown. Backfill the trench to 2_ feet above the top of pipe prior to performing the required pressure tests. Leave the joints and couplings uncovered during the pressure test.

3.10.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.

3.10.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 6 inches loose thickness.

3.10.1.3 Bedding and Initial Backfill
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Provide bedding of the type and thickness shown. Place initial backfill material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Compact backfill to top of pipe to 95 percent of ~~ASTM D698~~ laboratory maximum density. Provide plastic piping with bedding to spring line of pipe. Provide materials as follows:

3.10.1.3.1 Class I

Angular, 0.25 to 1.5 inch, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

3.10.1.3.2 Class II

Coarse sands and gravels with maximum particle size of 1.5 inch, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

3.10.1.3.3 Sand

Clean, coarse-grained sand classified as SW or SP by ASTM D2487 for backfill as indicated.

3.10.1.3.4 Gravel and Crushed Stone

Clean, coarsely graded natural gravel, crushed stone or a combination thereof having a classification of GW GP in accordance with ASTM D2487 for backfill as indicated.

3.10.1.4 Final Backfill

Fill the remainder of the trench, except for special materials for roadways, with satisfactory material. Place backfill material and compact as follows:

3.10.1.4.1 Roadways

Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.

3.10.1.4.2 Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas

Deposit backfill in layers of a maximum of 12 inches loose thickness, and compact it to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Do not permit compaction by water flooding or jetting. Apply this requirement to all other areas not specifically designated above.

3.10.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 5_ days, place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.11 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.11.1 Force Mains

Excavate trenches to a depth that provides a minimum cover as shown on the drawings.

3.11.2 Electrical Distribution System

Provide a minimum cover of 24 inches from the finished grade to direct burial cable and conduit or duct line, unless otherwise indicated.

3.12 EMBANKMENTS

3.12.1 Earth Embankments

Construct earth embankments from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. Place the material in successive horizontal layers of loose material not more than 12 inches in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is

placed. After spreading, plow, disk, or otherwise brake up each layer; moisten or aerate as necessary; thoroughly mix; and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements are identical with those requirements specified in paragraph SUBGRADE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.12.2 NOT USED

3.13 SUBGRADE PREPARATION

3.13.1 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Bring up low areas resulting from removal of unsatisfactory material to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 1/2 inch when tested with a 12-foot straightedge applied both parallel and at right angles to the centerline of the area. Do not vary the elevation of the finish subgrade more than 0.05 foot from the established grade and cross section.

3.13.2 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas, compact each layer of the embankment to at least 92 percent of laboratory maximum density.

3.13.2.1 Subgrade for Pavements

Compact subgrade for pavements to at least 95 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top 12_ inch of subgrade.

3.13.2.2 Subgrade for Shoulders

Compact subgrade for shoulders to at least 95 percentage laboratory maximum density for the full depth of the shoulder.

3.14 SHOULDER CONSTRUCTION

Construct shoulders of satisfactory excavated material or as otherwise shown or specified. Submit advanced notice on shoulder construction for rigid pavements. Construct shoulders immediately after adjacent paving is complete. In the case of rigid pavements, do not construct shoulders until permission of the Contracting Officer has been obtained. Compact the entire shoulder area to at least the percentage of maximum density as

specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Finish shoulder construction in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. Align the completed shoulders true to grade and shaped to drain in conformity with the cross section shown.

3.15 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.15.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.15.2 Grading Around Structures

Construct areas within 5 feet outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.16 TESTING

Perform testing by a Corps validated commercial testing laboratory or the Contractor's validated testing facility. Submit qualifications of the Corps validated commercial testing laboratory or the Contractor's validated testing facilities. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Corps validated and approved by the Contracting Officer.

a. Determine field in-place density in accordance with ASTM D1556 ASTM D2167 ASTM D6938. When ASTM D6938 is used, check the calibration curves and adjust using only the sand cone method as described in ASTM D1556. ASTM D6938 results in a wet unit weight of soil in determining the moisture content of the soil when using this method.

b. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938; check the

calibration of both the density and moisture gauges at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. ASTM D2937, use the Drive Cylinder Method only for soft, fine-grained, cohesive soils. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, remove the material, replace and recompact to meet specification requirements.

c. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.16.1 Fill and Backfill Material Gradation

One test per 1,000 cubic yards stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with ASTM C136 ASTM D422 ASTM D1140.

3.16.2 In-Place Densities

a. One test per 5,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per 1000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

c. One test per 100 linear feet, or fraction thereof, of each lift of embankment or backfill for roads.

3.16.3 Check Tests on In-Place Densities

If ASTM D6938 is used, check in-place densities by ASTM D1556 as follows:

a. One check test per lift for each 25,000_ square feet, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.

b. One check test per lift for each 5000_ square feet, of fill or backfill areas compacted by hand-operated machines.

c. One check test per lift for each 400_ linear feet, or fraction thereof, of embankment or backfill for roads.

3.16.4 NOT USED

3.16.5 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material to determine

the optimum moisture and laboratory maximum density values. One representative test per 1,000 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.16.6 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.16.7 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to 2, feet above the top of the pipe, inspect the pipe to determine whether significant displacement has occurred. Conduct this inspection in the presence of the Contracting Officer. Inspect pipe sizes larger than 36 inches, while inspecting smaller diameter pipe by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgment of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, replace or repair the defects as directed at no additional cost to the Government.

3.17 DISPOSITION OF SURPLUS MATERIAL

Remove surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber from Government property to an approved location as designated by the Contracting Officer if available, else dispose of materials outside the limits of Government-controlled land.

-- End of Section --

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GENERAL

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ND22G-001.DGN	G-001	COVER
ND22G-002.DGN	G-002	INDEX
ND22G-003.DGN	G-003	ABBREVIATIONS
ND22G-004.DGN	G-004	LEGEND
ND22G-005.DGN	G-005	ELECTRICAL LEGEND
ND22G-006.DGN	G-006	LOCATION PLAN

GEOTECHNICAL

	FILE NAME	SHEET ID NO.	DESCRIPTION
1	ND22B-101.DGN	B-101	SOIL BORING LOGS & LOCATION PLAN

CIVIL/SITE

FILE NAME	SHEET ID NO.	DESCRIPTION
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ND22VF101.DGN	VF101	EXISTING CONDITIONS PLAN - AREA 101
ND22VF102.DGN	VF102	EXISTING CONDITIONS PLAN - AREA 102
ND22VF103.DGN	VF103	EXISTING CONDITIONS PLAN - AREA 103
ND22VF104.DGN	VF104	EXISTING CONDITIONS PLAN - AREA 104
ND22CD100.DGN	CD100	OVERALL SITE DEMOLITION PLAN
ND22CD101.DGN	CD101	SITE DEMOLITION PLAN - AREA 101
ND22CD102.DGN	CD102	SITE DEMOLITION PLAN - AREA 102
ND22CD103.DGN	CD103	SITE DEMOLITION PLAN - AREA 103
ND22CD104.DGN	CD104	SITE DEMOLITION PLAN - AREA 104
ND22CS100.DGN	CS100	OVERALL SITE LAYOUT PLAN
ND22CS101.DGN	CS101	SITE LAYOUT PLAN - AREA 101
ND22CS103.DGN	CS103	SITE LAYOUT PLAN - AREA 103
ND22CS104.DGN	CS104	SITE LAYOUT PLAN - AREA 104
ND22CS401.DGN	CS401	ENLARGEMENT PLAN - CONC. PATIO AND BIKE RACK
ND22CS402.DGN	CS402	H.C. PARKING STRIPING PLAN
ND22CS501.DGN	CS501	DUMPSTER ENCLOSURE DETAILS
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ND22CE101.DGN	CE101	EROSION CONTROL - AREA 101
ND22CE103.DGN	CE103	EROSION CONTROL - AREA 103
ND22CE104.DGN	CE104	EROSION CONTROL - AREA 104
ND22CE501.DGN	CE501	EROSION CONTROL DETAILS
ND22CU101.DGN	CU101	WATER AND SEWER PLAN
ND22CU201.DGN	CU201	WATER LINE PROFILES
ND22CU202.DGN	CU202	SANITARY SEWER PROFILE
ND22CU501.DGN	CU501	SANITARY SEWER DETAILS
ND22CU502.DGN	CU502	WATER LINE DETAILS

MECHANICAL SITE

FILE NAME	SHEET ID NO.	DESCRIPTION
ND22MS101.DGN	MS101	MECHANICAL SITE PLAN

ELECTRICAL SITE

FILE NAME	SHEET ID NO.	DESCRIPTION
ND22ES101.DGN	ES101	ELECTRICAL AND TELECOMMUNICATIONS SITE PLAN
ND22ES501.DGN	ES501	ELECTRICAL SITE DETAILS
ND22ES502.DGN	ES502	COMMUNICATION SITE DETAILS

STRUCTURAL

FILE NAME	SHEET ID NO.	DESCRIPTION
ND22S-001.PDF	S-001	GENERAL STRUCTURAL NOTES
ND22S-002.PDF	S-002	FASTENING SCHEDULE AND OVER EXCAVATION
ND22S-003.PDF	S-003	COMPONENTS & CLADDING WIND LOAD DIAGRAMS
ND22S-004.PDF	S-004	ROOF TRUSS LOADING DIAGRAMS
ND22S-100.PDF	S-100	FOUNDATION AND SLAB PLAN
ND22S-110.PDF	S-110	ROOF FRAMING PLAN
ND22S-120.PDF	S-120	SHEAR AND LOAD BEARING WALL PLAN
ND22S-201.PDF	S-201	ROOF TRUSS PROFILES
ND22S-202.PDF	S-202	ROOF TRUSS PROFILES
ND22S-203.PDF	S-203	TRUSS BRACING DETAILS
ND22S-210.PDF	S-210	SHEAR WALL SECTIONS
ND22S-211.PDF	S-211	SHEAR WALL SECTIONS
ND22S-301.PDF	S-301	FOUNDATION SECTIONS AND DETAILS
ND22S-302.PDF	S-302	FOUNDATION SECTIONS AND DETAILS
ND22S-303.PDF	S-303	ROOF CONNECTIONS
ND22S-304.PDF	S-304	ROOF CONNECTIONS
ND22S-305.PDF	S-305	BEARING WALL DETAILS

ARCHITECTURAL

FILE NAME	SHEET ID NO.	DESCRIPTION
ND22A-110.PDF	A-110	COMPOSITE FLOOR PLAN
ND22A-120.PDF	A-120	COMPOSITE ATTIC/CLERESTORY PLAN
ND22A-130.PDF	A-130	ROOF PLAN
ND22A-140.PDF	A-140	FIRST FLOOR REFLECTED CEILING PLAN
ND22A-200.PDF	A-200	BUILDING ELEVATIONS
ND22A-201.PDF	A-201	BUILDING ELEVATIONS
ND22A-300.PDF	A-300	BUILDING SECTIONS
ND22A-301.PDF	A-301	BUILDING SECTIONS
ND22A-302.PDF	A-302	BUILDING SECTIONS
ND22A-303.PDF	A-303	BUILDING SECTIONS
ND22A-400.PDF	A-400	WALL SECTIONS
ND22A-401.PDF	A-401	WALL SECTIONS
ND22A-402.PDF	A-402	WALL SECTIONS
ND22A-403.PDF	A-403	WALL SECTIONS
ND22A-410.PDF	A-410	WALL TYPES
ND22A-420.PDF	A-420	ENLARGED PLANS
ND22A-421.PDF	A-421	ENLARGED PLANS
ND22A-430.PDF	A-430	INTERIOR ELEVATIONS
ND22A-431.PDF	A-431	INTERIOR ELEVATIONS
ND22A-440.PDF	A-440	CASEWORK SECTIONS
ND22A-441.PDF	A-441	CASEWORK SECTIONS
ND22A-442.PDF	A-442	CASEWORK SECTIONS
ND22A-450.PDF	A-450	TYPICAL EQUIPMENT MOUNTING DETAILS
ND22A-451.PDF	A-451	WALL FINISH DETAILS
ND22A-500.PDF	A-500	PLAN DETAILS
ND22A-510.PDF	A-510	CANOPY AND CEILING DETAILS
ND22A-520.PDF	A-520	WALL AND ROOF EDGE DETAILS
ND22A-530.PDF	A-530	ROOF DETAILS
ND22A-600.PDF	A-600	ROOM FINISH SCHEDULE
ND22A-610.PDF	A-610	DOOR AND WINDOW SCHEDULES
ND22A-700.PDF	A-700	DOOR DETAILS
ND22A-710.PDF	A-710	WINDOW DETAILS
ND22A-711.PDF	A-711	LOUVER DETAILS
ND22A-720.PDF	A-720	MISCELLANEOUS DETAILS
ND22A-900.PDF	A-900	BUILDING ISOMETRICS
ND22A-901.PDF	A-901	BUILDING ISOMETRICS
ND22A-902.PDF	A-902	BUILDING PERSPECTIVES
ND22A-903.PDF	A-903	BUILDING PERSPECTIVES

INTERIORS

FILE NAME	SHEET ID NO.	DESCRIPTION
ND22I-110.PDF	I-110	COMPOSITE FURNITURE, FINISH AND SIGNAGE PLAN
ND22IG101.PDF	IG101	SIGNAGE TYPICALS

FIRE PROTECTION

FILE NAME	SHEET ID NO.	DESCRIPTION
ND22F-050.PDF	F-050	COMPOSITE FIRST FLOOR LIFE SAFETY PLAN
ND22FA111.PDF	FA111	LEGEND AND ABBREVIATIONS
ND22FA121.PDF	FA121	FIRE ALARM PLAN
ND22FA501.PDF	FA501	FIRE ALARM & MASS NOTIFICATION DETAILS
ND22FA601.PDF	FA601	FIRE ALARM & MASS NOTIFICATION RISER
ND22FA602.PDF	FA602	FIRE ALARM & MASS NOTIFICATION RISER MATRIX
ND22FX110.PDF	FX110	COMPOSITE FIRST FLOOR FIRE PROTECTION PLAN
ND22FX501.PDF	FX501	FIRE PROTECTION DETAILS

MECHANICAL

FILE NAME	SHEET ID NO.	DESCRIPTION
ND22P-110.PDF	P-110	COMPOSITE FIRST FLOOR PLUMBING PLAN
ND22P-120.PDF	P-120	COMPOSITE ATTIC/CLERESTORY PLUMBING PLAN
ND22P-410.PDF	P-410	ENLARGED PLUMBING PLANS - UNITS 1, 2, 3, 4, 7 & 8
ND22P-411.PDF	P-411	ENLARGED PLUMBING PLANS - UNITS 5 & 6
ND22P-412.PDF	P-412	ENLARGED PLUMBING PLANS - LAUNDRY, RESTROOM & UTILITIES
ND22P-500.PDF	P-500	PLUMBING DETAILS
ND22P-501.PDF	P-501	PLUMBING DETAILS
ND22P-600.PDF	P-600	PLUMBING SCHEDULES
ND22P-900.PDF	P-900	WASTE & VENT ISOMETRIC
ND22P-901.PDF	P-901	DOMESTIC WATER & NATURAL GAS ISOMETRIC
ND22M-101.PDF	M-101	FIRST FLOOR MECHANICAL DUCTWORK PLAN
ND22M-102.PDF	M-102	ATTIC / CLERESTORY MECHANICAL DUCTWORKG PLAN
ND22M-103.PDF	M-103	FIRST FLOOR MECHANICAL HYDRONIC PIPING PLAN
ND22M-104.PDF	M-104	ATTIC / CLERESTORY MECHANICAL HYDRONIC PIPING PLAN
ND22M-105.PDF	M-105	COMPOSITE ROOF MECHANICAL PLAN
ND22M-400.PDF	M-400	ENLARGED MECHANICAL ROOM PLAN
ND22M-400A.PDF	M-400A	SECTION VIEW 1,2
ND22M-400B.PDF	M-400B	SECTION VIEW 3,4
ND22M-401.PDF	M-401	SECTION VIEW1 (SUPPLY DUCT)
ND22M-402.PDF	M-402	SECTION VIEW1 (BATHROOM EXHAUST)
ND22M-403.PDF	M-403	SECTION VIEW1 (RETURN DUCT)
ND22M-500.PDF	M-500	MECHANICAL DETAILS-1
ND22M-501.PDF	M-501	MECHANICAL DETAILS-2
ND22M-502.PDF	M-502	MECHANICAL DETAILS-3
ND22M-600.PDF	M-600	MECHANICAL SCHEDULE-1
ND22M-601.PDF	M-601	MECHANICAL SCHEDULE-2
ND22M-700.PDF	M-700	MECHANICAL CONTROL-1
ND22M-701.PDF	M-701	MECHANICAL CONTROL-2
ND22M-702.PDF	M-702	MECHANICAL CONTROL-3
ND22M-703.PDF	M-703	BOILER CONTROL
ND22M-900.PDF	M-900	MECHANICAL PLAN ISOMETRIC VIEW

ELECTRICAL

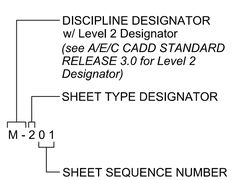
FILE NAME	SHEET ID NO.	DESCRIPTION
ND22EG001.PDF	EG001	GROUNDING LEGEND
ND22EG140.PDF	EG140	GROUNDING PLAN
ND22EG501.PDF	EG501	GROUNDING DETAILS
ND22EG601.PDF	EG601	GROUNDING RISER
ND22EL001.PDF	EL001	LIGHTING LEGEND AND ABBREVIATIONS
ND22EL101.PDF	EL101	MAIN FLOOR LIGHTING PLAN
ND22EL102.PDF	EL102	ATTIC LIGHTING PLAN
ND22EL503.PDF	EL503	LIGHTING DETAILS
ND22EL504.PDF	EL504	LIGHTING DETAILS
ND22EL505.PDF	EL505	LIGHTING DETAILS
ND22EL601.PDF	EL601	LIGHT FIXTURE SCHEDULE
ND22EP001.PDF	EP001	LEGEND AND ABBREVIATIONS
ND22EP101.PDF	EP101	MAIN FLOOR POWER PLAN
ND22EP110.PDF	EP110	ATTIC POWER PLAN
ND22EP401.PDF	EP401	ENLARGED POWER PLAN & DETAILS
ND22EP502.PDF	EP502	ROOM 001 ELECTRICAL SECTIONS
ND22EP503.PDF	EP503	MOUNTING HEIGHT DETAIL
ND22EP601.PDF	EP601	ELECTRICAL ONE-LINE DIAGRAM
ND22EP602.PDF	EP602	MECHANICAL EQUIPMENT-ELECTRICAL CONNECTIONS SCHEDULE
ND22EP603.PDF	EP603	PANEL SCHEDULES
ND22EP604.PDF	EP604	PANEL SCHEDULES CONT.
ND22EP605.PDF	EP605	PANEL SCHEUDLES CONT.
ND22EY001.PDF	EY001	SYSTEMS LEGEND AND ABBREVIATIONS
ND22EY601.PDF	EY601	SYSTEMS RISERS & DETAILS

TELECOMMUNICATIONS

FILE NAME	SHEET ID NO.	DESCRIPTION
ND22TN001.PDF	TN001	TELECOMMUNICATIONS LEGEND
ND22TN110.PDF	TN110	TELECOMMUNICATIONS PLAN
ND22TN501.PDF	TN501	TELECOMMUNICATIONS DETAILS
ND22TN502.PDF	TN502	TELECOMMUNICATIONS DETAILS
ND22TN503.PDF	TN503	TELECOMMUNICATIONS DETAILS
ND22TN504.PDF	TN504	TELECOMMUNICATIONS DETAILS
ND22TN601.PDF	TN601	TELECOMMUNICATIONS RISER

INDEX LEGEND:

1. SHEET IDENTIFICATION NUMBERS:


DISCIPLINE DESIGNATOR
w/ Level 2 Designator
(see A/E/C CADD STANDARD RELEASE 3.0 for Level 2 Designator)
SHEET TYPE DESIGNATOR
M - 2 0 1
SHEET SEQUENCE NUMBER

2. DISCIPLINE DESIGNATORS:

G	GENERAL
H	HAZARDOUS MATERIALS
V	SURVEY / MAPPING
B	GEOTECHNICAL
C	CIVIL
L	LANDSCAPE
S	STRUCTURAL
A	ARCHITECTURAL
I	INTERIORS
Q	EQUIPMENT
F	FIRE PROTECTION
P	PLUMBING
D	PROCESS
M	MECHANICAL
E	ELECTRICAL
T	TELECOMMUNICATIONS
R	RESOURCE

3. SHEET TYPE DESIGNATORS:

0	GENERAL
1	PLANS
2	ELEVATIONS
3	SECTIONS
4	LARGE-SCALE VIEWS
5	DETAILS
6	SCHEDULES & DIAGRAMS
7	USER DEFINED
8	USER DEFINED
9	3D REPRESENTATIONS

US Army Corps of Engineers
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	AM #0001 GENERAL REVISIONS	04-14-2015	

DESIGNED BY: L.B.C.
DRN BY: L.B.C.
SUBMITTED BY: L.B.C.
PLOT SCALE:
DATE: 03/23/2015
CKD BY: L.B.C.
PLOT DATE:
SIZE:
SOLICITATION NO.: W912BF-15-B-0007
CONTRACT NO.:
FILE NUMBER: 447213-1441
FILE NAME: ND22G-002.dgn

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND

INDEX

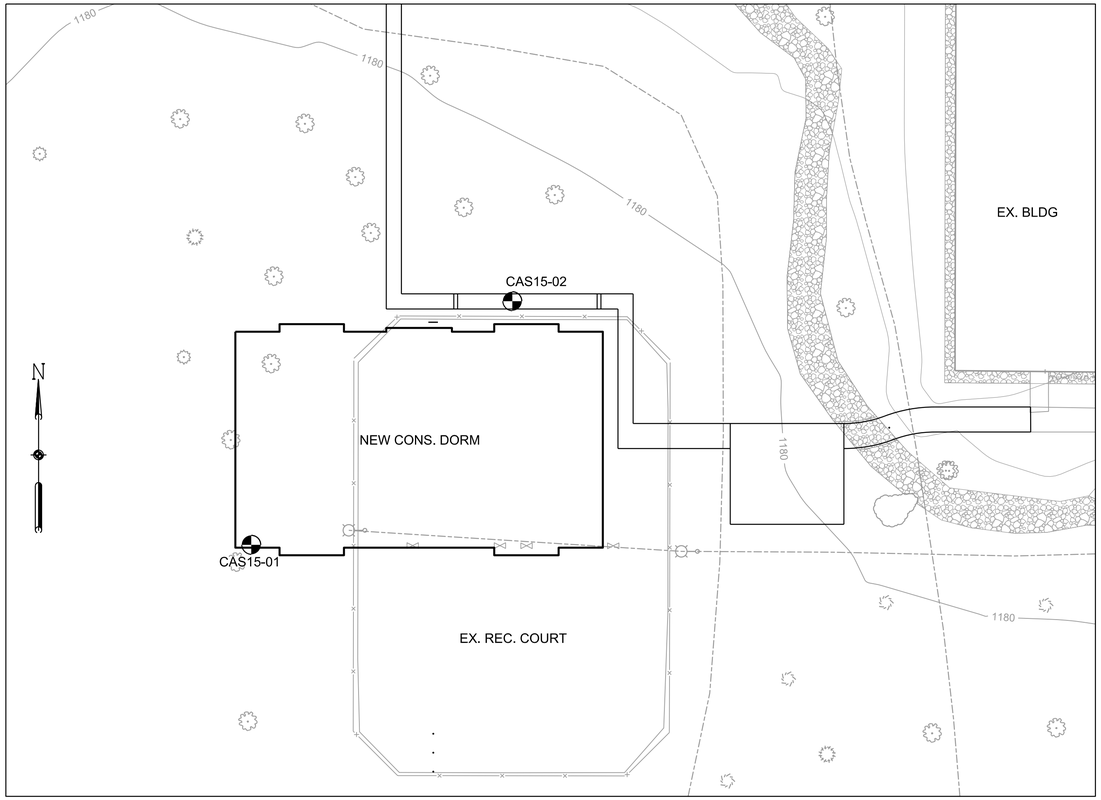
SHEET IDENTIFICATION
G-002

CAS15-01
MAR. 25, 2015

N	M	LL	PI	
				TOPSOIL, 10", black
		TOPSOIL		
9		49 SC	20	CLAYEY SAND, brown to light gray, loose, 37% fine sand, 25% fines, 25% medium sand, 12% coarse sand, 1% fine gravel, dry
31		SP-SM		SAND, brown to light gray, dense, 37% fine sand, 35% medium sand, 15% coarse sand, 10% fines, 3% fine gravel, dry, some shale pieces
52		SP-SM		Field Log - SAND, gray, very dense, fine to coarse sand, with gravel, dry
28		CL		Field Log - LEAN CLAY, brown, very stiff, with lenses and layers of silty sand, dry
26		SP-SM		Field Log - SAND, brown, medium dense, fine to coarse sand, with gravel, sl. saturated, trace shale pieces
21		CH		Field Log - FAT CLAY (WEATHERED SHALE), dark gray, very stiff to hard, damp
During & ▽ After Drilling 41				

CAS15-02
MAR. 25, 2015

N	M	LL	PI	
				TOPSOIL, 10", black
		TOPSOIL		
14		61 SC	29	CLAYEY SAND, brown to light gray, medium dense, fine sand, fines, medium sand, some coarse sand, trace fine gravel, dry
20		SP-SM		SAND, light gray, medium dense, 26% fine sand, 22% fine gravel, 20% medium sand, 20% coarse sand, 12% fines, dry, with shale pieces
26				
20		SM		Field Log - SILTY SAND, brown to gray, medium dense, fine sand, dry
20		SP-SM		Field Log - SAND, brown, medium dense, fine to coarse sand, with gravel, dry, trace shale pieces
During & ▽ After Drilling 23				
		CH		Field Log - FAT CLAY (WEATHERED SHALE), dark gray, very stiff to hard, damp
39				



BORING LOCATION PLAN

0 10' 20' 40'

BORING LEGEND

CAS15-01	Drill hole number
MAR. 25, 2015	Date boring completed
LL	Liquid limit
PI	Plasticity index
N	Standard penetration blow count. Number of blows for a 140-pound weight dropping 30 inches, to drive a 2-inch outside diameter sampler, 1 foot.
% fines	Percent of soil by dry weight passing the No.200 sieve
During & ▽ After Drilling	Ground water level encountered and time
Field Log - SAND	Soil Classification based on field logs
LEAN CLAY	Soil Classification based on Laboratory Testing and Laboratory Visual Descriptions
CAS15-01	Drill Hole Designation and Location

BORING NOTES

1. THE DESCRIPTIVE DATA AT THE RIGHT OF THE LOGS ARE THE RESULTS OF FIELD AND LABORATORY DATA. THE TERMS "DRY, MOIST, WET, ETC" ARE FIELD DESCRIPTIONS MADE BY THE INSPECTOR AT THE TIME OF DRILLING.
2. THE LOGS FURNISHED REPRESENT THE TYPES OF SOIL ENCOUNTERED AT THEIR RESPECTIVE LOCATIONS AND THE WATER LEVEL ENCOUNTERED AT THAT TIME. THE BORING LOGS ARE CONSIDERED REPRESENTATIVE OF THE SOILS WHICH WERE ENCOUNTERED; HOWEVER, THE WATER LEVEL CAN FLUCTUATE APPRECIABLY AT DIFFERENT SEASONS OF THE YEAR OR FROM YEAR TO YEAR DEPENDING LARGELY ON CLIMATIC CONDITIONS. THE CONTRACTOR SHOULD SATISFY HIMSELF AS TO THE GROUND WATER CONDITIONS.
3. FIELD LOGS, LABORATORY CLASSIFICATION DATA, AND TEST RESULTS, ARE ON FILE IN THE OMAHA DISTRICT OFFICE AND ARE AVAILABLE FOR EXAMINATION BY ANY INTERESTED CONTRACTOR AT SAID OFFICE.

US Army Corps of Engineers
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	AM.#0001 NEW DRAWING ADDED	04/14/15	B.N.J.

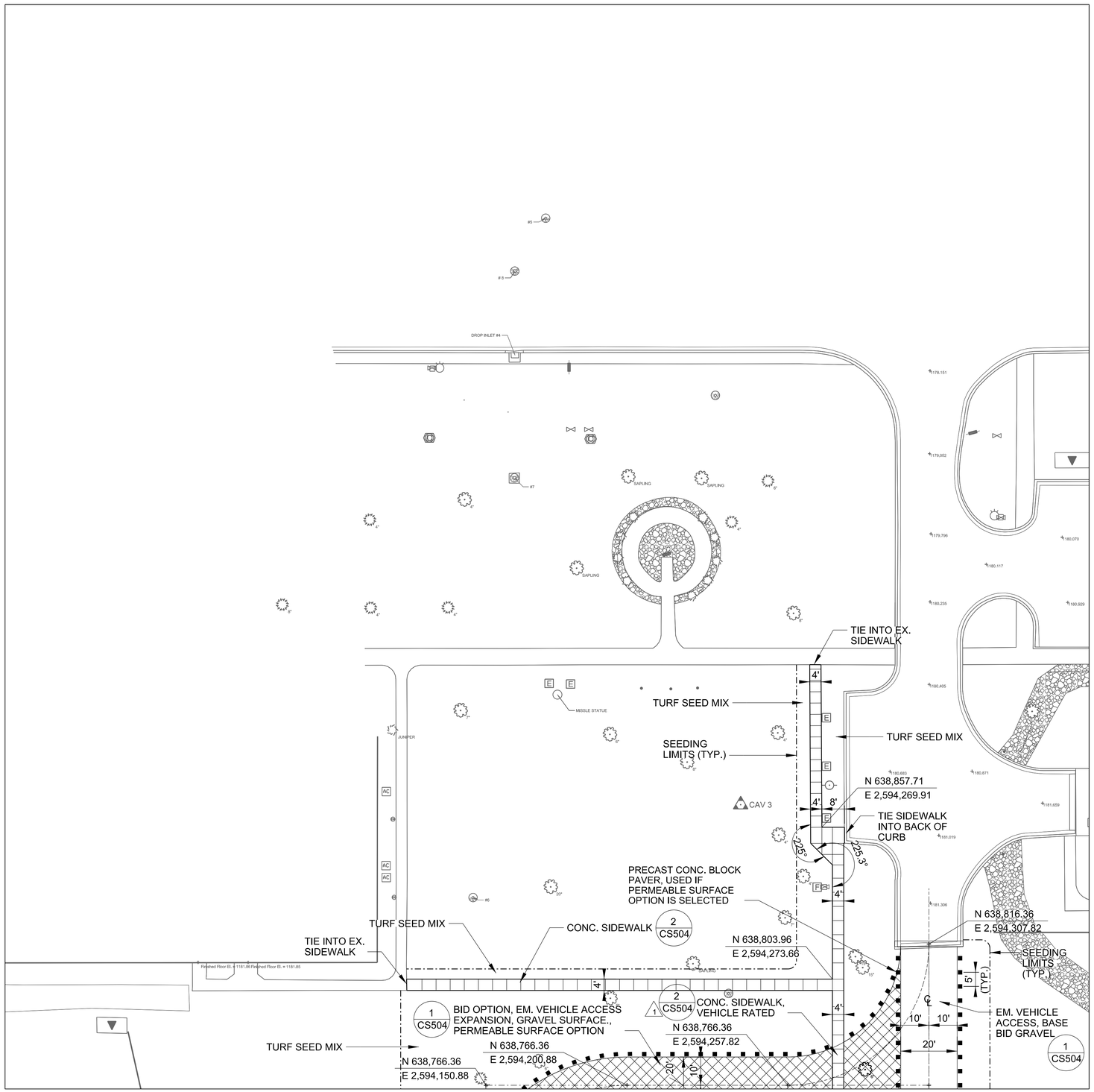
U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

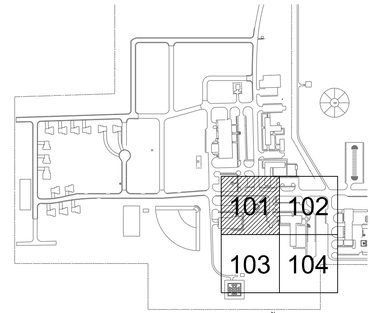
DESIGNED BY: C.A.F.
DWN BY: C.A.F.
CKD BY: J.C.F.
SUBMITTED BY: B.N.J.
DATE: 04/14/2015
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.:
PLOT SCALE:
PLOT DATE:
FILE NUMBER: P-FTC-13-041
SIZE: ANSI D
FILE NAME: ND22B-101.dgn

CONSOLIDATED DORMITORY
CAVALIER AFS, ND

SOIL BORING LOGS & LOCATION PLAN

SHEET IDENTIFICATION
B-101





KEY PLAN SCALE: 1" = 500'

GENERAL NOTES:

1.) DIMENSIONS TO BUILDING ARE TO FACE OF SIPS PANEL.

2.) ALL CURB DIMENSIONS ARE TO BACK OF CURB

N

0 10' 20' 40'

SCALE 1" = 20'

US Army Corps of Engineers®
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	AM#001 GENERAL REVISIONS	04/14/15	TJD

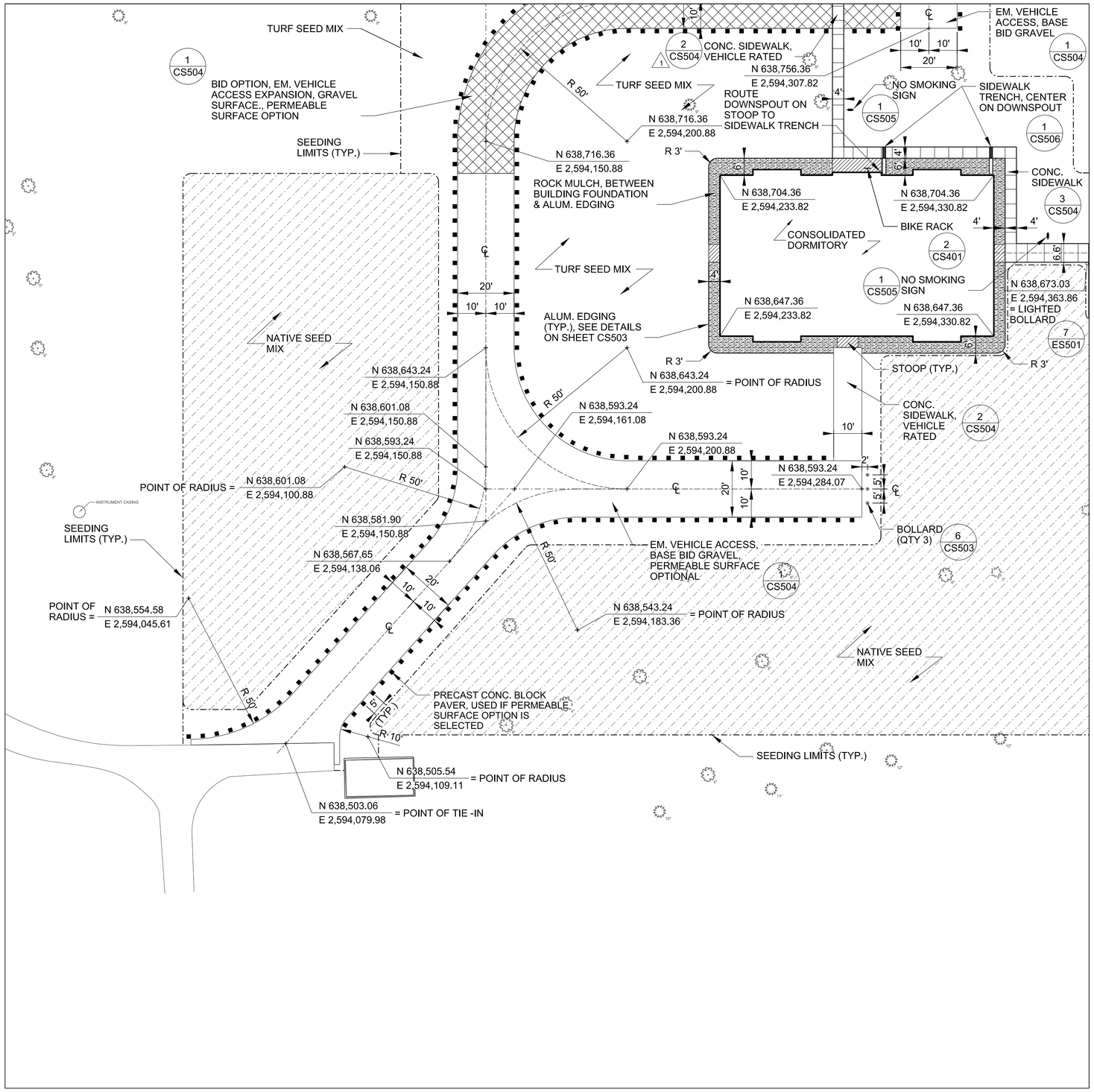
DESIGNED BY: TJD
DRWN BY: TJD
SUBMITTED BY:
PLOT SCALE:
SIZE:
DATE: 03/23/2015
CKD BY: MTJ
PLOT DATE:
FILE NAME: ND22CS101.dgn
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.:
FILE NUMBER: AFZ-13-0441

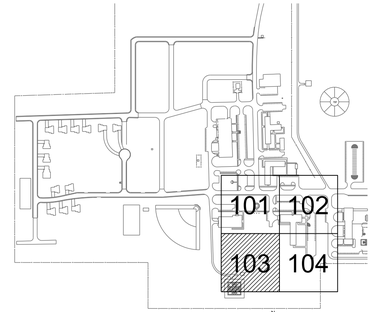
U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND

SITE LAYOUT PLAN
AREA 101

SHEET IDENTIFICATION
CS101





KEY PLAN SCALE: 1" = 500'

GENERAL NOTES:

1.) DIMENSIONS TO BUILDING ARE TO FACE OF SIPS PANEL.

2.) ALL CURB DIMENSIONS ARE TO BACK OF CURB

N

0 10' 20' 40'

SCALE 1" = 20'

US Army Corps of Engineers
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	AMR001 GENERAL REVISIONS	04/14/15	TJD

DESIGNED BY: TJD
DRWN BY: TJD
SUBMITTED BY:
CKD BY: MTJ
PLOT SCALE
SIZE:
DATE: 03/23/2015
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.:
PLOT DATE:
FILE NAME: N22CS103.dgn
FILE NUMBER: 407214-451

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND

SITE LAYOUT PLAN
AREA 103

SHEET IDENTIFICATION
CS103

GYMNASIUM
BLDG. 715
(EXISTING)

ENLISTED COMPLEX
BLDG. 720 (EXISTING)

DORMITORY

CONNECT NEW 8" WATER LINE
TO EXISTING 10" WATER LINE
POB 8" W-1 @ STA. 0+00.00

EXISTING GAS LINE

EXISTING ELEC. LINES

EXISTING COMM. LINE

W-1 STA.
1+00

EXISTING WATER LINE

EXISTING SS MH
PI @ STA. 1+89.00
RIM. EL. = 1180.55
8" I.E. IN = 1171.50
EXIST. I.E. OUT = 1171.0+/-
POE S-1 @ STA. 1+89.00

CONNECT TO EXISTING
WATER LINE (LOCATION
APPROXIMATE) .

PI @ W-1 STA. 1+89.25
(APPROXIMATE)

W-1 STA.
2+00

EXISTING COMM. LINES

EXISTING WATER LINE

EXISTING ELEC. LINE

SS MH-1
N 638,718.64
E 2,594,292.24
PI @ STA. 0+07.0
RIM. EL. = 1182.0
6" I.E. IN = 1172.71
8" I.E. OUT = 1172.21

1 6" TEE AT @ W-1
AT STA. 2+53.70
N 638,750.64
E 2,594,248.60

POB S-1 STA. 0+00.00
N 638,711.64
E 2,594,292.24
CONNECT TO 4" SS FROM
BUILDING, SEE SHT. P-110
FOR CONTINUATION

PI @ W-1 AT
STA. 2+86.00
N 638,718.33
E 2,594,248.60

W-1 AT
STA. 3+00

PI @ W-1 AT
STA. 3+06.00
N 638,718.33
E 2,594,228.60

6" TEE @ W-1
STA. 4+13.00
N 638,611.33
E 2,594,228.60

W-1 STA.
4+00

END 8" FW-1 @ STA. 0+63.30
N 638,643.64 E 2,594,293.85
CONNECT TO 8" FW @ BLDG.
SEE SHT. P-110 FOR CONTINUATION

END 3" W-2 @ STA. 0+49.30
N 638,643.64 E 2,594,279.78
CONNECT TO 2-1/2" LINE AT BLDG.
SEE SHT. P-110 FOR CONTINUATION

PIV @ FW-1 STA. 0+26.00
N 638,606.33 E 2,594,293.85

PI @ FW-1 STA. 0+14.00
N 638,594.33 E 2,594,293.85

PI @ W-1
STA. 3+06.00
N 638,594.33
E 2,594,228.60

8" TEE @ W-1 STA. 4+81.20
BEGIN FW-1 @ STA. 0+00.00
N 638,594.33 E 2,594,279.78

FH-1
FH-2
PIV

8" W
6" W
2-1/2" W
8" FW
8" SS

WATER AND SEWER PLAN

0 30' 60'
SCALE: 1" = 30'

N

US Army Corps of Engineers
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	GENERAL REVISIONS	04/14/15	DHC

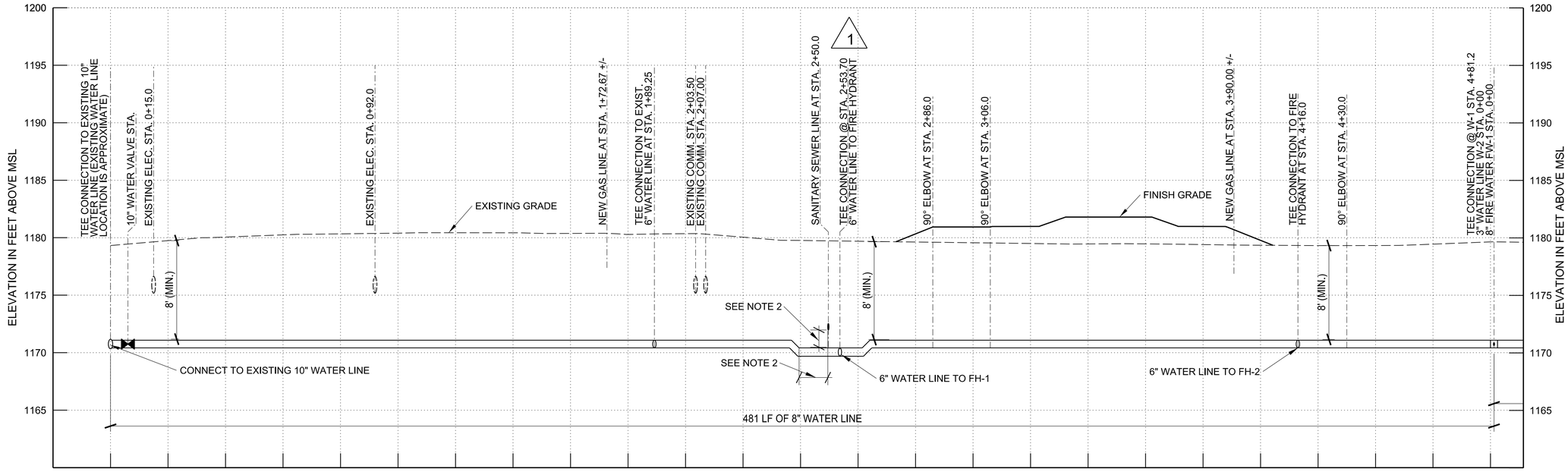
DESIGNED BY:
DWN BY:
CKD BY:
SUBMITTED BY:
DATE: 03/23/2015
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.:
PLOT SCALE:
PLOT DATE:
FILE NUMBER: AFZC-15-1401
SIZE:
FILE NAME: ND22CU101.dgn

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

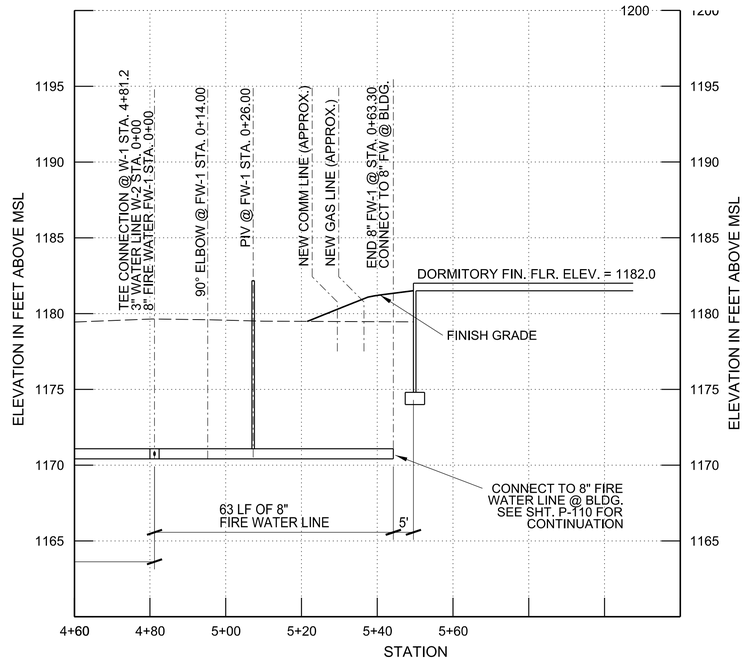
CONSOLIDATED DORMITORY
CAVALIER AFS, ND

WATER AND SEWER PLAN

SHEET IDENTIFICATION
CU101


TEE CONNECTION TO EXISTING 10" WATER LINE (EXISTING WATER LINE LOCATION IS APPROXIMATE)
10" WATER VALVE STA.
EXISTING ELEC. STA. 0+15.0
EXISTING ELEC. STA. 0+82.0
NEW GAS LINE AT STA. 1+72.67 +/-
TEE CONNECTION TO EXIST. 6" WATER LINE AT STA. 1+99.25
EXISTING COMM. STA. 2+03.50
EXISTING COMM. STA. 2+07.00
SANITARY SEWER LINE AT STA. 2+50.0
1
TEE CONNECTION @ STA. 2+53.70 6" WATER LINE TO FIRE HYDRANT
90° ELBOW AT STA. 2+86.0
90° ELBOW AT STA. 3+06.0
NEW GAS LINE AT STA. 3+90.00 +/-
TEE CONNECTION TO FIRE HYDRANT AT STA. 4+16.0
90° ELBOW AT STA. 4+30.0
TEE CONNECTION @ W-1 STA. 4+81.2
3" WATER LINE W-2 STA. 0+00
8" FIRE WATER FW-1 STA. 0+00
EXISTING GRADE
FINISH GRADE
8' (MIN.)
SEE NOTE 2
CONNECT TO EXISTING 10" WATER LINE
6" WATER LINE TO FH-1
6" WATER LINE TO FH-2
481 LF OF 8" WATER LINE
ELEVATION IN FEET ABOVE MSL
1200
1195
1190
1185
1180
1175
1170
1165
0+00 0+20 0+40 0+60 0+80 1+00 1+20 1+40 1+60 1+80 2+00 2+20 2+40 2+60 2+80 3+00 3+20 3+40 3+60 3+80 4+00 4+20 4+40 4+60 4+80
STATION

WATER LINE PROFILE


TEE CONNECTION @ W-1 STA. 4+81.2
3" WATER LINE W-2 STA. 0+00
8" FIRE WATER FW-1 STA. 0+00
90° ELBOW @ FW-1 STA. 0+14.00
PIV @ FW-1 STA. 0+26.00
NEW COMM LINE (APPROX.)
NEW GAS LINE (APPROX.)
END 8" FW-1 @ STA. 0+63.30 CONNECT TO 8" FW @ BLDG.
DORMITORY FIN. FLR. ELEV. = 1182.0
FINISH GRADE
CONNECT TO 8" FIRE WATER LINE @ BLDG. SEE SHT. P-110 FOR CONTINUATION
63 LF OF 8" FIRE WATER LINE
5'
ELEVATION IN FEET ABOVE MSL
1200
1195
1190
1185
1180
1175
1170
1165
4+60 4+80 5+00 5+20 5+40 5+60
STATION

FIRE WATER LINE PROFILE

NOTES:

1. THE LOCATIONS AND DEPTHS OF ALL EXISITNG UTILITY LINES ARE APPROXIMATE. THE CONTRACTOR SHALL VERIFY THE LOCATIONS AND DEPTHS OF ALL EXISITNG UTILITY LINES PRIOR TO BEGINNING CONSTRUCTION.
2. THE WATER LINE SHALL BE PLACED AT A DEPTH THAT ACHIEVES A MINIMUM OF 18" VERTICAL CLEARANCE AND MINIMUM 10' HORIZONTAL CLEARANCE BETWEEN THE WATER LINE AND THE SANITARY SEWER PIPE.

SCALE: VERT. 1 INCH = 5 FT.
HORIZ. 1 INCH = 20 FT.

5' 0 5'
SCALE: 1" = 5'

20' 10' 0 20'
SCALE: 1" = 20'

US Army Corps of Engineers®
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	GENERAL REVISIONS	04/14/15	DHC

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

DESIGNED BY: JLR	DRAWN BY: JLR	CKD BY: DHC	SUBMITTED BY: DHC
DATE: 03/23/2015	SOLICITATION NO.: W9128F-15-B-0007	CONTRACT NO.:	PLOT DATE:
PLOT SCALE	FILE NUMBER: P-272-L3-451		
SIZE:	FILE NAME: N22SCU201.dgn		

CONSOLIDATED DORMITORY
CAVALIER AFS, ND

WATER LINE PROFILES

SHEET IDENTIFICATION
CU201

I. DESIGN LOADS

A. DESIGN CODES:
- ASCE 7-10 — MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES
- IBC 2012 — INTERNATIONAL BUILDING CODE
- UFC 3-301-01 — STRUCTURAL ENGINEERING (LATEST EDITION)

B. FLOOR LIVE LOAD
1) ATTIC — 20 PSF
2) RESIDENTIAL - PRIVATE — 40 PSF
3) RESIDENTIAL - PUBLIC — 100 PSF
4) MECHANICAL ROOM — 125 PSF

C. ROOF LIVE LOAD
1) ROOF CONSTRUCTION — 20 PSF
2) ROOF LIVE (DISTRIBUTED OR CONCENTRATED)
   a) DISTRIBUTED — 20 PSF (REDUCIBLE)
   b) CONCENTRATED — 300 LBS

D. SNOW LOAD
1) GROUND SNOW, Pg — 60 PSF
2) FLAT-ROOF SNOW LOAD, Pf — 37.8 PSF
3) EXPOSURE FACTOR, Ce — 0.9
4) IMPORTANCE FACTOR, Is — 1.0
5) THERMAL FACTOR, Ct — 1.0
6) SNOW DENSITY, Y — 21.8 PCF
7) UNBALANCED, SLIDING, AND DRIFT: SEE SNOW LOAD DIAGRAMS

E. WIND LOAD
1) BASIC WIND SPEED (3 SECOND GUST) — 115 MPH
2) RISK CATEGORY — II
3) EXPOSURE CATEGORY — C
4) INTERNAL PRESSURE COEFFICIENT, GCpi — +/-0.18
5) ROOF AND WALL COMPONENTS AND CLADDING: SEE WIND LOAD DIAGRAMS

F. SEISMIC LOAD
1) RISK CATEGORY — II
2) SEISMIC IMPORTANCE CATEGORY, Ie — 1.0
3) Ss — 0.035g
4) S1 — 0.015g
5) SITE CLASS — D
6) SDS — 0.037g
7) SD1 — 0.024g
8) SEISMIC DESIGN CATEGORY — A
9) BASIC SEISMIC FORCE RESISTING SYSTEM:
   a) BEARING WALL SYSTEMS: LIGHT-FRAME (WOOD) WALLS SHEATHED WITH WOOD STRUCTURAL PANELS RATED FOR SHEAR RESISTANCE
10) DESIGN BASE SHEAR — 2.82 KIPS
11) SEISMIC RESPONSE COEFFICIENT, Cs — 0.006
12) RESPONSE MODIFICATION COEFFICIENT, R — 6.5
13) ANALYSIS PROCEDURE: EQUIVALENT LATERAL FORCE PROCEDURE

G. GEOTECHNICAL INFORMATION
1) FOUNDATIONS HAS BEEN DESIGNED WITH THE FOLLOWING ASSUMED GEOTECHNICAL SOIL PROPERTIES. FOUNDATION HAS BEEN VERIFIED WITH THE FINAL GEOTECHNICAL REPORT PREPARED BY THE GOVERNMENT.
2) FOOTING DEPTH: MINIMUM 8 FEET BENEATH FINISHED EXTERIOR GRADE FOR HEATED STRUCTURES. 8 FOOT REQUIREMENT IS NOT LISTED IN THE REPORT BUT RATHER PROVIDED BY THE INSTALLATION.
3) FOOTING TYPE: CONTINUOUS FOOTINGS FOR EXTERIOR WALLS AND THICKENED SLABS FOR INTERIOR WALLS.
4) NET ALLOWABLE BEARING PRESSURE: 2,000 PSF (ALL FOOTING TYPES)
   THIS PRESSURE ASSUMES NOT MORE THAN 2 FEET OF FILL BE ADDED TO THE SITE TO ACHIEVE FINISHED GRADE. IF MORE THAN 2 FEET OF FILL WILL BE ADDED TO THE SITE, THE PRESSURE SHALL BE DECREASED BY MULTIPLYING 110 PCF BY EACH FOOT OF FILL AND SUBTRACTING THIS NUMBER FROM THE ALLOWABLE BEARING PRESSURE.
5) PAVEMENT DESIGN
   a) FROST GROUP — F3
   b) ASPHALT PAVEMENT — 5 CBR
   c) CONCRETE PAVEMENT — 150 PCI
6) ALL COMPACTED FILL INSTALLATION SHALL BE INSPECTED AND APPROVED BY A REGISTERED GEOTECHNICAL ENGINEER. A REGISTERED GEOTECHNICAL ENGINEER SHALL INSPECT AND APPROVE BEARING MATERIALS PRIOR TO PLACEMENT OF CONCRETE.
7) BACKFILL AROUND FOUNDATION WALLS SHALL BE PLACED ON EACH SIDE OF THE WALL IN EQUAL LIFTS.
8) SEE SPECIFICATION SECTION 31 00 00 FOR ADDITIONAL EARTHWORK REQUIREMENTS.

II. GENERAL NOTES

A. REFERENCE ELEVATION 100'-0" = TOP OF FINISHED FLOOR SLAB, SEE CIVIL SHEETS FOR MEAN SEA LEVEL ELEVATION.

B. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND COORDINATE LOCATIONS OF ALL EMBEDDED ITEMS, CONDUITS, PIPES, AND OPENINGS.

C. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FIRESTOPPING ALL GAPS BETWEEN WALLS AND OVERLYING FLOORS, DECKING, AND STRUCTURE AS WELL AS OTHER PENETRATIONS AS REQUIRED BY ARCHITECTURAL, MECHANICAL, AND ELECTRICAL SHEETS, AND BY THE CONTRACT SPECIFICATIONS.

D. THE CONTRACTOR SHALL PROVIDE AND MAINTAIN ADEQUATE BRACING AND SHORING FOR WORK AT ALL TIMES DURING CONSTRUCTION.

III. REINFORCED CONCRETE

A. DESIGN CODES: BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE (ACI-318)

B. MATERIAL STRENGTHS:
1) CONCRETE COMPRESSIVE STRENGTH (f'c) AT 28 DAYS NORMAL WEIGHT:

ITEM	f'c	FREEZE THAW EXPOSURE CLASS	SULFATE EXPOSURE CLASS	PERMEABILITY	CORROSION PROTECTION
EXTERIOR PAVEMENT, DOOR STOOPS	4.5 KSI	F3	S0	P0	C2
ALL OTHER CONCRETE	4.5 KSI	F2	S0	P0	C1

B. MATERIAL STRENGTHS CONTINUED:
2) REINFORCING STEEL:
   - BARS (NOT WELDED) — ASTM A615, GR. 60 KSI
   - BARS (WELDED) — ASTM A706, GR. 60 KSI
   - TIES — ASTM A615, GR. 60 KSI
   - WELDED WIRE REINFORCEMENT — ASTM A185

C. NOTES
1) ALL CONCRETE OPERATIONS AND REINFORCEMENT SHALL BE IN ACCORDANCE WITH THE LATEST ACI AND CRSI STANDARDS.
2) REFER TO THE ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS FOR ADDITIONAL EMBEDDED ITEMS AND ACCESSORIES. NO CALCIUM CHLORIDE OR OTHER DELETERIOUS SALTS ARE PERMITTED IN CONCRETE. NO ALUMINUM EMBEDMENT IS PERMITTED. PROVIDE 3/4" CHAMFER AT ALL EXPOSED CORNERS.
3) FURNISH THE FOLLOWING CONCRETE COVER ON REINFORCING BARS UNO:
   - SLAB ON GRADE — 1.5" COVER AT TOP
   - SLABS ON METAL FORMS — CENTER MESH IN PORTION OF SLAB ABOVE METAL FORMS
   - FOUNDATIONS — 3" COVER ON BOTTOM AND SIDES
   - WALLS — 2" UNO
4) PROVIDE THE FOLLOWING CONCRETE FINISHES UNO:
   - WALLS — PER SPECIFICATIONS
   - FOUNDATIONS — PER SPECIFICATIONS
   - SLABS TO BE EXPOSED — PER SPECIFICATIONS

III. REINFORCED CONCRETE CONTINUED...

5) LONGITUDINAL REINFORCING IN THE FOUNDATION SHALL BE PLACED CONTINUOUS AT CORNERS AND INTERSECTIONS. MATCHING CORNER BARS SHALL BE USED PER THE TYPICAL CONCRETE REINFORCEMENT DETAILS ON THE CONTRACT DRAWINGS.

6) ALL CONCRETE IS REINFORCED UNLESS SPECIFICALLY CALLED OUT AS UNREINFORCED. REINFORCE ALL CONCRETE NOT OTHERWISE SHOWN WITH SAME STEEL AS IN SIMILAR SECTIONS OR AREAS.

7) ALL ADJOINING SURFACES NOT CAST MONOLITHICALLY SHALL BE INTENTIONALLY ROUGHENED TO 1/4" AMPLITUDE AT EXISTING CONCRETE SURFACE FOR THE ENTIRE INTERSECTING SURFACE. APPLY BONDING AGENT TO EXISTING CONCRETE PRIOR TO PLACING NEW CONCRETE.

8) CONTRACTOR SHALL COORDINATE LOCATIONS OF ALL FLOOR DRAINS, FLOOR FINISHES, CURBS, CONCRETE PADS, AND SLAB DEPRESSIONS WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.

9) CONTRACTOR SHALL FIELD VERIFY DIMENSIONS AND LOCATIONS OF ALL OPENINGS, PIPE SLEEVES, CURBS, ETC. AS REQUIRED WITH OTHER TRADES PRIOR TO PLACING CONCRETE.

10) CONTRACTOR SHALL COORDINATE LOCATIONS OF INSERTS AND OTHER ITEMS EMBEDDED IN CONCRETE WITH ARCHITECTURAL DRAWINGS, MECHANICAL DRAWINGS, AND OTHER TRADES.

IV. STRUCTURAL STEEL

A. CAST-IN-PLACE ANCHOR RODS: ASTM F1554, GR. 36, UNO

B. WELDING ELECTRODES FOR ALL WORK SHALL BE E70XX.

C. ALL STRUCTURAL STEEL AND THEIR CONNECTIONS SHALL BE DETAILED, FABRICATED, AND ERECTED ACCORDING TO THE LATEST VERSION OF THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC) MANUAL OF STEEL CONSTRUCTION.

D. ALL WELDING SHALL BE DONE BY AMERICAN WELDING SOCIETY (AWS) CERTIFIED WELDERS.

V. STRUCTURAL WOOD

A. DESIGN, FABRICATION, AND CONSTRUCTION OF WOOD FRAMING MUST CONFORM WITH:
1) AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC) "TIMBER CONSTRUCTION MANUAL" (6TH EDITION, 2012).
2) AMERICAN WOOD COUNCIL (AWC) "NATIONAL DESIGN SPECIFICATIONS (NDS) FOR WOOD CONSTRUCTION" (2012 EDITION).

B. UNLESS SPECIFICALLY NOTED OTHERWISE ON THE DRAWINGS SAWN LUMBER GRADING SHALL BE AS FOLLOWS:
1) 2X JOISTS DFL-NORTH (OR HF) NO 2
2) PLATES/BLOCKING DFL-NORTH (OR HF) NO 2
3) PLATES ON CONC (PRESSURE TREAT) DFL-NORTH NO 1
4) WALL AND FLOOR SHEATHING DFL-NORTH OR SP

C. GRADE STAMP SHALL BE VISIBLE ON EVERY PIECE OF LUMBER IN PLACE (EXCLUDING BLOCKING).

D. POSTS, STUDS, CHORDS, STRUTS, AND OTHER FRAMING MEMBERS SHALL BE SAWN DOUGLAS-FIR-LARCH (NORTH) NO. 2 OR OTHER GRADE AND SPECIES HAVING THE MINIMUM BASE DESIGN VALUES IN THE NATIONAL DESIGN SPECIFICATION SUPPLEMENT TABLE 4A AS LISTED BELOW (BEFORE APPLYING ADJUSTMENT FACTORS):
1) FB = 850 PSI (BENDING)
2) FT = 500 PSI (TENSION PARALLEL TO GRAIN)
3) FV = 180 PSI (SHEAR PARALLEL TO GRAIN)
4) FC = 1400 PSI (COMPRESSION PARALLEL TO GRAIN)
5) FC (PERP) = 625 PSI (COMPRESSION PERPENDICULAR TO GRAIN)
6) E = 1,600,000 PSI (MODULUS OF ELASTICITY FOR DEFLECTION)
7) EMIN' = 580,000 PSI (MODULUS OF ELASTICITY FOR STABILITY

E. STRUCTURAL GLUED LAMINATED TIMBER (SGLT) SHALL BE HORIZONTALLY LAMINATED MEMBERS MANUFACTURED IN ACCORDANCE WITH THE "TIMBER CONSTRUCTION MANUAL" OF THE AITC.
1) LUMBER SHALL BE SOUTHERN PINE OR DOUGLAS FIR-KD 24F-1.8E OR OTHER GRADE AND SPECIES HAVING THE MINIMUM BASE DESIGN VALUES IN THE NATIONAL DESIGN SPECIFICATION SUPPLEMENT TABLE 5A AS LISTED BELOW (BEFORE APPLYING ADJUSTMENT FACTORS):
   a) FB = 2400 PSI (POSITIVE BENDING ABOUT X-AXIS)
   b) FV = 230 PSI (SHEAR PARALLEL TO GRAIN)
   c) FC (PERP) = 650 PSI (COMPRESSION PERPENDICULAR TO GRAIN)
   d) E = 1,800,000 PSI (MODULUS OF ELASTICITY FOR DEFLECTION)
   e) EMIN' = 950,000 PSI (MODULUS OF ELASTICITY FOR STABILITY
2) ADHESIVES TO BE IN ACCORDANCE WITH AMERICAN NATIONAL STANDARD ANSI/AITC A190.1

F. EXPOSED TRUSSES AND FRAMING IN THE COMMUNITY ROOM AND ON THE ENTRYWAY ROOF CANOPY SHALL BE NORTHERN WHITE CEDAR NO. 1 WITH MINIMUM BASE DESIGN VALUES IN THE NATIONAL DESIGN SPECIFICATION SUPPLEMENT TABLE 4A AS LISTED BELOW (BEFORE APPLYING ADJUSTMENT FACTORS):
1) FB =575 PSI (BENDING)
2) FT = 325 PSI (TENSION PARALLEL TO GRAIN)
3) FV = 120 PSI (SHEAR PARALLEL TO GRAIN)
4) FC = 600 PSI (COMPRESSION PARALLEL TO GRAIN)
5) FC (PERP) = 370 PSI (COMPRESSION PERPENDICULAR TO GRAIN)
6) E = 700,000 PSI (MODULUS OF ELASTICITY FOR DEFLECTION)
7) EMIN' = 260,000 PSI (MODULUS OF ELASTICITY FOR STABILITY

G. LAMINATED VENEER LUMBER (LVL) USED FOR HEADERS IN BEARING WALLS SHALL HAVE THE MINIMUM ALLOWABLE STRESSES AS LISTED BELOW:
1) FB =2600 PSI (BENDING)
2) FV = 285 PSI (SHEAR PARALLEL TO GRAIN)
3) FC = 2500 PSI (COMPRESSION PARALLEL TO GRAIN)
4) FC (PERP) = 750 PSI (COMPRESSION PERPENDICULAR TO GRAIN)
5) E = 1,800,000 PSI (MODULUS OF ELASTICITY FOR DEFLECTION)

H. ALL CONNECTIONS FOR JOISTS, BEAMS, TRUSSES, AND MANUFACTURED WOOD FRAMING TO BE MADE WITH APPROPRIATE METAL HANGARS, FRAMING ANGLES, CONNECTORS, STRAPS, ETC:
1) BOLTS OR LAG SCREWS PER ASTM A325 SPECIFICATIONS
2) NAILS TO BE COMMON NOT BOX (NAILS TO BE GALVANIZED)
3) THE QUANTITY AND SIZE OF NAILS AND OTHER FASTENERS CONNECTING WOOD MEMBERS MUST NOT BE LESS THAN THE FASTENING SCHEDULE ON SHEET S-002.

I. SPECIAL INSPECTIONS
1) CONTINUOUS SPECIAL INSPECTION DURING ALL FIELD GLUING OF ELEMENTS OF THE LATERAL FORCE RESISTING SYSTEM IS REQUIRED.
2) PERIODIC SPECIAL INSPECTION IS REQUIRED FOR NAILING, BOLTING, ANCHORING, AND OTHER FASTENING OF COMPONENTS WITHIN THE MAIN WIND FORCE RESISTING SYSTEM INCLUDING WOOD SHEAR WALLS, WOOD DIAPHRAGMS, DRAG STRUTS, BRACES, AND HOLD-DOWNS.

VI. SPECIAL INSPECTION NOTES (IBC 2012)

A. FABRICATORS PER SECTION 1704.2.

B. SPECIAL INSPECTION IS NOT REQUIRED FOR WORK PERFORMED BY AN APPROVED FABRICATOR PER IBC SECTION 1704.2.5.2.

C. CONTINUOUS SPECIAL INSPECTION MEANS THAT THE SPECIAL INSPECTOR IS ON THE SITE AT ALL TIMES OBSERVING THE WORK REQUIRING SPECIAL INSPECTION. PERIODIC SPECIAL INSPECTION MEANS THAT THE SPECIAL INSPECTOR IS ON SITE AT ALL TIME INTERVALS NECESSARY TO CONFIRM THAT ALL WORK REQUIRING SPECIAL INSPECTION IS IN COMPLIANCE.

D. ALL WELDS SHALL BE VISUALLY INSPECTED PER AWS D1.1/D1.1M:2010, STRUCTURAL WELDING CODE - STEEL.

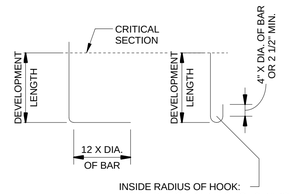
E. INSPECTION FOR PREFABRICATED CONSTRUCTION SHALL BE THE SAME AS IF THE MATERIAL USED IN THE CONSTRUCTION TOOK PLACE ON SITE. CONTINUOUS INSPECTION WILL NOT BE REQUIRED DURING PREFABRICATION IF THE APPROVED AGENCY CERTIFIES THE CONSTRUCTION AND FURNISHES EVIDENCE OF COMPLIANCE.

F. INSPECTION OF DRILLED CONCRETE ANCHORS, INCLUDING EXPANSION AND ADHESIVE GROUTED ANCHORS, SHALL INCLUDE VISUAL VERIFICATION OF DRILLED HOLE DEPTH, SPACING, EDGE DISTANCES AND HOLE CLEANING. FOR GROUTED ANCHORS, GROUT INSTALLATION SHALL BE OBSERVED AND GROUT PRODUCT

G. INCLUDE SPECIAL INSPECTION REQUIREMENTS IN CONTRACTOR'S QUALITY CONTROL (CQC) PLAN.

REINFORCING DEVELOPMENT AND SPLICES				
BAR SIZE	DEVELOPMENT LENGTH		SPLICE LENGTH	
	OTHER	TOP	OTHER	TOP
#3	1'-2"	1'-6"	1'-6"	1'-11"
#4	1'-6"	2'-0"	2'-0"	2'-7"
#5	1'-11"	2'-6"	2'-6"	3'-2"
#6	2'-3"	2'-11"	2'-11"	3'-10"
#7	3'-4"	4'-3"	4'-3"	5'-7"
#8	3'-9"	4'-11"	4'-11"	6'-4"
#9	4'-3"	5'-6"	5'-6"	7'-2"
#10	4'-9"	6'-2"	6'-2"	8'-0"
#11	5'-4"	6'-10"	6'-10"	8'-11"

DEVELOPMENT LENGTHS HOOKED BARS	
BAR SIZE	LENGTH OR MIN. EMBEDMENT
#3	7"
#4	9"
#5	1'-0"
#6	1'-2"
#7	1'-4"
#8	1'-6"
#9	1'-9"
#10	1'-11"
#11	2'-2"



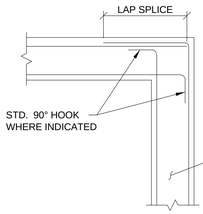
INSIDE RADIUS OF HOOK:
6 x DIA. OF BAR - #3 TO #8 BARS
8 x DIA. OF BAR - #9 TO #11 BARS
10 x DIA. OF BAR - #14 & #18 BARS

1. REINFORCING BAR DEVELOPMENT AND LAP SPLICE LENGTH SHALL BE AS SHOWN UNLESS OTHERWISE NOTED ON THE DRAWINGS.

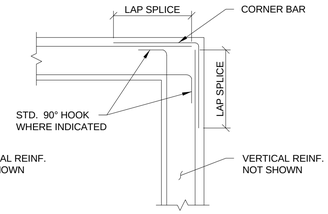
2. TOP BARS ARE DEFINED AS HORIZONTAL REINFORCEMENT SUCH THAT MORE THAN 12 INCHES OF FRESH CONCRETE IS CAST IN THE MEMBER BELOW THE DEVELOPMENT LENGTH OR SPLICE.

3. WHERE DEVELOPMENT AND SPLICE LENGTH DO NOT MEET THE FOLLOWING CONDITIONS DEVELOPMENT ANS SPLICE LENGTHS SHALL BE DETERMINED BY ACI 318-11:
A) f'c < 4500 PSI
B) fy > 60,000 PSI
C) THE COVER OR C-C BAR SPACING IS NOT AS LISTED ABOVE
D) THE REINFORCING STEEL IS EPOXY COATED
E) LIGHT WEIGHT CONCRETE IS USED.
F) THE FOLLOWING CONCRETE COVERAGE AND REINFORCING C-C SPACING:
BEAMS OR COLUMNS:
COVER (EQUAL OR MORE) 1.0bd (BAR DIAMETER)
CENTER TO CENTER (C-C) SPACING (EQUAL OR MORE) 2.0bd.
ALL OTHERS:
COVER (EQUAL OR MORE) 1.0bd
CENTER TO CENTER SPACING (EQUAL OR MORE) 3.0bd.

4. CENTER ON CENTER SPACING (S) IS DEFINED AS BELOW:



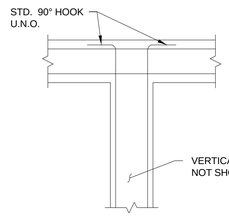
PLAN
OPTION #1



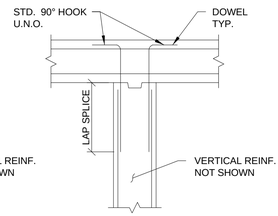
PLAN
OPTION #2

CORNERS

NOTE:
UNLESS OTHERWISE INDICATED, THE CONTRACTOR HAS THE OPTION OF REINFORCING CORNERS IN ACCORDANCE WITH OPTION #1 OR OPTION #2.



PLAN
WITHOUT CJ



PLAN
WITH CJ

INTERSECTIONS

NOTE:
UNLESS OTHERWISE INDICATED, THE CONTRACTOR HAS THE OPTION OF CONSTRUCTING INTERSECTIONS WITH OR WITHOUT CONSTRUCTION JOINTS. REINFORCE PER APPLICABLE DETAIL.

US Army Corps of Engineers ®
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

ISSUE DATE: 03-23-2015
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.: -
FILE NUMBER: #4761-334-041
DESIGN BY: JOSBORN
DRAWN BY: K.REPASKEY
CKD BY: T.CAMPBELL
SBMT BY: W.BEDECK
PLOT DATE: 4/14/2015 5:53:56 PM
PLOT SCALE: As indicated
SIZE: 22" x 34"
FILE NAME:

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

GENERAL STRUCTURAL NOTES

SHEET IDENTIFICATION
S-001

S-001-

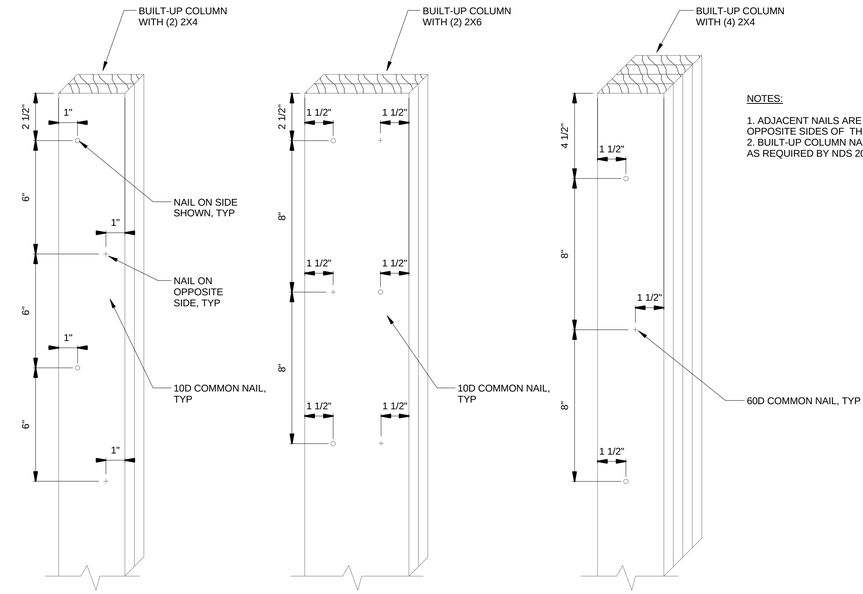
INTERNATIONAL BUILDING CODE (IBC) 2012
TABLE 2304.9.1 FASTENING SCHEDULE

CONNECTION	COMMON NAILS (1)	LOCATION
1. JOIST TO SILL OR GIRDER	3 - 8d	TOENAIL
2. BRIDGING TO JOIST	2 - 8d	TOENAIL EACH END
3. 1" X 6" SUBFLOOR OR LESS TO EACH JOIST	2 - 8d	FACE NAIL
4. WIDER THAN 1" X 6" SUBFLOOR TO EACH JOIST	3 - 8d	FACE NAIL
5. 2" SUBFLOOR TO JOIST OR GIRDER	2 - 16d	BLIND AND FACE NAIL
6. SOLE PLATE TO JOIST OR BLOCKING	16d @ 16" O.C.	TOENAIL EACH END
SOLE PLATE TO JOIST OR BLOCKING AT BRACED WALL PANEL	3 - 16d @ 16" O.C.	BRACED WALL PANELS
7. TOP PLATE TO STUD	2 - 16d	END NAIL
8. STUD TO SOLE PLATE	4 - 8d 2 - 16d	TOENAIL END NAIL
9. DOUBLE STUDS	16d @ 24" O.C.	FACE NAIL
10. DOUBLE TOP PLATES	16d @ 16" O.C. 8 - 16d	TYPICAL FACE NAIL LAP SPLICE
11. BLOCKING BETWEEN JOISTS OR RAFTERS TO TOP PLATE	3 - 8d	TOENAIL
12. RIM JOIST TO TOP PLATE	8d @ 6" O.C.	TOENAIL
13. TOP PLATES, LAPS AND INTERSECTIONS	2 - 16d	FACE NAIL
14. CONTINUOUS HEADER, TWO PIECES	16d	16" O.C. ALONG EDGE
15. CEILING JOISTS TO PLATE	3 - 8d	TOENAIL
16. CONTINUOUS HEADER TO STUD	4 - 8d	TOENAIL
17. CEILING JOISTS, LAPS OVER PARTITIONS (SEE TABLE 2308.10.4.1)	3 - 16d	FACE NAIL
18. CEILING JOISTS TO PARALLEL RAFTERS (SEE TABLE 2308.10.4.1)	3 - 16d	FACE NAIL
19. RAFTER TO PLATE (SEE TABLE 2308.10.4.1)	3 - 8d	TOENAIL
20. 1" DIAGONAL BRACE TO EACH STUD AND PLATE	2 - 8d	FACE NAIL
21. 1" X 8" SHEATHING TO EACH BEARING	3 - 8d	FACE NAIL
22. WIDER THAN 1" X 8" SHEATHING TO EACH BEARING	3 - 8d	FACE NAIL
23. BUILT-UP CORNER STUD	16d @ 24" O.C.	
24. BUILT-UP GIRDER AND BEAMS	20d @ 32" O.C. 2 - 20d	FACE NAIL AT TOP & BOTTOM STAGGERED ON OPPOSITE SIDES FACE NAIL AT ENDS AND AT EACH SPLICE
25. 2" PLANKS	16d	AT EACH BEARING
26. COLLAR TIE TO RAFTER	3 - 10d	FACE NAIL
27. JACK RAFTER TO HIP	3 - 10d 2 - 16d	TOENAIL FACE NAIL
28. ROOF RAFTER TO 2-BY RIDGE BEAM	2 - 16d 2 - 16d	TOENAIL FACE NAIL
29. JOIST TO BAND JOIST	3 - 16d	FACE NAIL
30. LEDGER STRIP	3 - 16d	FACE NAIL @ EACH JOIST
31. WOOD STRUCTURAL PANELS AND PARTICLEBOARD (2)		
SUBFLOOR AND WALL SHEATHING (TO FRAMING)		
1/2" AND LESS	6d (3, 12)	
19/32" TO 3/4"	8d (4) OR 6d (5)	
7/8" TO 1"	8d (3)	
1 1/8" TO 1 1/4"	10d (4) OR 8d (5)	
SINGLE FLOOR (COMBINATION SUBFLOOR-UNDERLAYMENT TO FRAMING		
3/4" AND LESS	6d (5)	
7/8" TO 1"	8d (5)	
1 1/8" TO 1 1/4"	10d (4) OR 8d (5)	
32. PANEL SIDING (TO FRAMING)		
1/2" OR LESS	6d (6)	
5/8"	8d (6)	
33. FIBERBOARD SHEATHING (7)		
1/2"	6d	NO. 11 GAGE ROOFING NAIL (8)
25/32"	8d	NO. 11 GAGE ROOFING NAIL (8)
34. INTERIOR PANELING		
1/4"	4d (10)	
3/8"	6d (11)	

(1) COMMON OR BOX NAILS ARE PERMITTED TO BE USED EXCEPT WHERE OTHERWISE STATED.
(2) NAILS SPACED 6 INCHES ON CENTER AT EDGES, 12 INCHES AT INTERMEDIATE SUPPORTS EXCEPT 6 INCHES AT SUPPORTS WHERE SPANS ARE 48 INCHES OR MORE. FOR NAILING OF WOOD STRUCTURAL PANEL AND PARTICLEBOARD DIAPHRAGMS AND SHEAR WALLS REFER TO IBC 2012 SECTION 2305. NAILS FOR WALL SHEATHING ARE PERMITTED TO BE COMMON, BOX OR CASING.
(2) STAPLES SHALL HAVE A MINIMUM CROWN WIDTH OF 7/16 INCH.
(3) COMMON OR DEFORMED SHANK
(4) COMMON
(5) DEFORMED SHANK
(6) CORROSION-RESISTANT SIDING OR CASING NAIL
(7) FASTENERS SPACED 3 INCHES ON CENTER AT EXTERIOR EDGES AND 6 INCHES ON CENTER AT INTERMEDIATE SUPPORTS, WHEN USED AS STRUCTURAL SHEATHING. SPACING SHALL BE 6 INCHES ON CENTER ON THE EDGES AND 12 INCHES ON CENTER AT INTERMEDIATE SUPPORTS FOR NONSTRUCTURAL APPLICATIONS.
(8) CORROSION-RESISTANT ROOFING NAILS WITH 7/16" DIAMETER HEAD AND 1 1/2" LENGTH FOR 1/2" SHEATHING AND 1 3/4" LENGTH FOR 25/32" SHEATHING
(9) CORROSION-RESISTANT STAPLES WITH 7/16" CROWN OR 1" CROWN AND 1 1/4" LENGTH FOR 1/2" SHEATHING AND 1 1/2" LENGTH OR 25/32" SHEATHING. PANEL SUPPORTS AT 16 INCHES (20 INCHES IF STRENGTH AXIS IN THE LONG DIRECTION OF THE PANEL, UNLESS OTHERWISE MARKED).
(10) CASING (1 1/2" X 0.080") OR FINISH (1 1/2" X 0.072") NAILS SPACED 6 INCHES ON PANEL EDGES, 12 INCHES AT INTERMEDIATE SUPPORTS.
(11) PANEL SUPPORTS AT 24 INCHES. CASING OR FINISH NAILS SPACED 6" ON PANEL EDGES, 12" AT INTERMEDIATE SUPPORTS.
(12) FOR ROOF SHEATHING APPLICATIONS, 8d NAILS ARE THE MINIMUM REQUIRED FOR WOOD STRUCTURAL PANELS
(13) STAPLES SHALL HAVE A MINIMUM CROWN WIDTH OF 7/16".
(14) FASTENERS SPACED 4" ON CENTER AT EDGES, 8" AT INTERMEDIATE SUPPORTS FOR SUBFLOOR AND WALL SHEATHING AND 3" ON CENTER AT EDGES, 6" AT INTERMEDIATE SUPPORTS FOR ROOF SHEATHING.
(15) FASTENERS SPACED 4" ON CENTER AT EDGES, 8" AT INTERMEDIATE SUPPORTS

NOTES:

1. THE FASTENING SCHEDULE ON THIS SHEET SHOWS MINIMUM REQUIREMENTS UNLESS NOTED OTHERWISE. SEE DETAILS ON OTHER STRUCTURAL SHEETS FOR ADDITIONAL NAILING REQUIREMENTS.



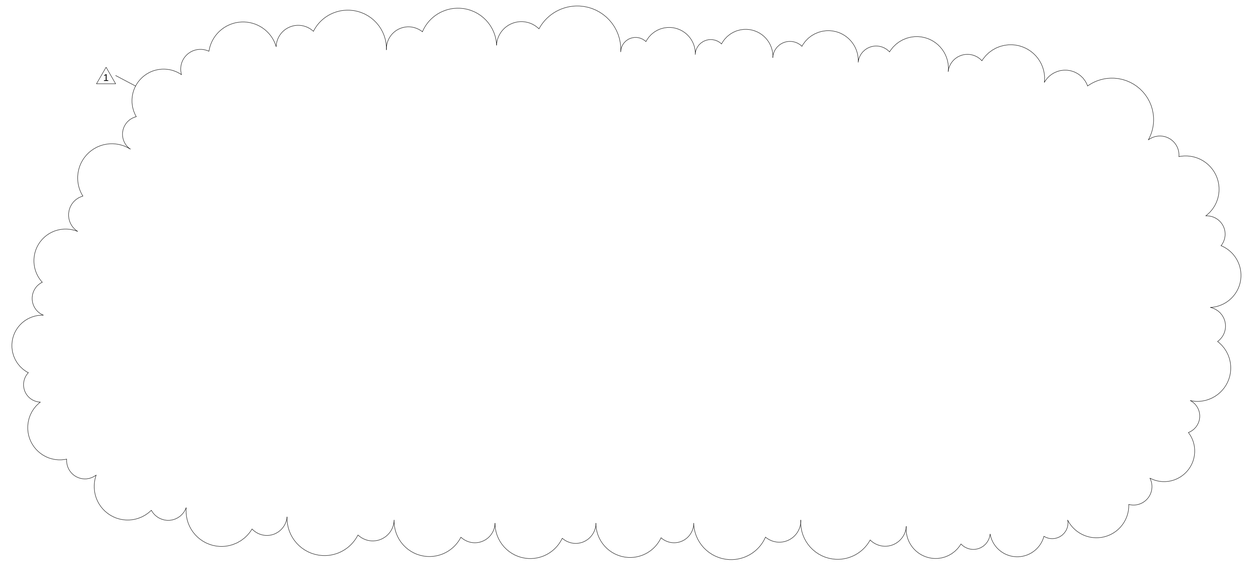
NOTES:

1. ADJACENT NAILS ARE DRIVEN FROM OPPOSITE SIDES OF THE COLUMN.
2. BUILT-UP COLUMN NAIL SPACING SHOWN IS AS REQUIRED BY NDS 2012 CHAPTER 15.

1 S-002

BUILT-UP COLUMN NAILING DETAIL

3" = 1'-0"



US Army Corps of Engineers ®
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

ISSUE DATE: 03-23-2015
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.: -
FILE NUMBER: A4723-134-01
DESIGN BY: J.OSBORN
DRAWN BY: J.OSBORN
CKD BY: T.CAMPBELL
SBMT BY: M.BECK
PLOT DATE: 4/14/2015 5:54:10 PM
PLOT SCALE: As Indicated
SIZE: 22" x 34"
FILE NAME:

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

FASTENING SCHEDULE AND OVER EXCAVATION

SHEET IDENTIFICATION
S-002

S-002-

FIRE DETECTION/MASS NOTIFICATION

A C	FIRE ALARM/MASS NOTIFICATION SPEAKER/STROBE, WALL MOUNTED 8' AFF. "A"=AMBER AND "C"=CLEAR
S C	FIRE ALARM/MASS NOTIFICATION SPEAKER/STROBE, CEILING OR PENDANT MOUNTED. "C"=CLEAR
A C	FIRE ALARM/MASS NOTIFICATION STROBE, CEILING MOUNTED. "A"=AMBER AND "C"=CLEAR. BOTH "A" AND "C" = ONE OF EACH.
A C	FIRE ALARM/MASS NOTIFICATION STROBE, WALL MOUNTED 8' AFF. "A"=AMBER AND "C"=CLEAR. BOTH "A" AND "C" = ONE OF EACH.
S F	FIRE ALARM/MASS NOTIFICATION SPEAKER, CEILING OR PENDANT MOUNTED.
	FIRE ALARM/MASS NOTIFICATION SPEAKER, WALL MOUNTED 8' AFF UNLESS NOTED OTHERWISE.
P	MANUAL PULL STATION - 48" AFF
P	PHOTO ELECTRIC SMOKE DETECTOR, CEILING MOUNTED
CO	CO DETECTOR
ASD	AIR SAMPLER, CEILING MOUNTED
S D	DUCT SMOKE DETECTOR
F	FIXED TEMPERATURE HEAT DETECTOR, CEILING MOUNTED (135 DEGREE UNLESS NOTED OTHERWISE)
R/F	RATE OF RISE/FIXED TEMPERATURE HEAT DETECTOR, CEILING MOUNTED (165 DEGREE UNLESS NOTED OTHERWISE)
FMCP	FIRE ALARM/MASS NOTIFICATION CONTROL PANEL
FSCP	FIRE SUPPRESSION CONTROL PANEL
ANN	FIRE ALARM ANNUNCIATOR PANEL
FAT	FIRE ALARM TRANSCEIVER
LOC	MASS NOTIFICATION LOCAL OPERATING CONSOLE
	TAMPER SWITCH
	FLOW SWITCH
	FIRE ALARM ANTENNA
R	FIRE ALARM DOOR RELEASE RELAY
K	KNOX BOX. MOUNTED 48" AFF.
	HVAC EMERGENCY SHUTDOWN. MOUNTED 48" AFF.
CM	CONTROL MODULE FOR SHUNT TRIP BREAKER.

ABBREVIATIONS

A	AMPERE
AC	ABOVE COUNTER, 42"AFF UNLESS OTHERWISE INDICATED
ADA	AMERICANS WITH DISABILITIES ACT
AFF	ABOVE FINISHED FLOOR
AL	ALUMINUM
1/C	ONE CONDUCTOR
C	CONDUIT
CB	CIRCUIT BREAKER
CKT	CIRCUIT
CU	COPPER
EF	EXHAUST FAN
EMT	ELECTRICAL METALLIC TUBING
EWC	ELECTRIC WATER COOLER
FACP	FIRE ALARM CONTROL PANEL
FAT	FIRE ALARM TRANSCEIVER
FM	FREQUENCY MODULATION
FMCP	FIRE ALARM/MASS NOTIFICATION CONTROL PANEL
GFI	GROUND FAULT CIRCUIT INTERRUPTER
GFP	GROUND FAULT PROTECTION
HACR	HEATING AIR CONDITIONING REFRIGATION
HP	HORSEPOWER
HPS	HIGH PRESSURE SODIUM
HT	HEIGHT
HZ	HERTZ
IDS	INTRUSION DETECTION SYSTEM
J	JUNCTION BOX
KWH	KILOWATT HOUR
LED	LIGHT EMITTING DIODE
MCB	MOLDED CASE CIRCUIT BREAKER
MH	METAL HALIDE
MLO	MAIN LUGS ONLY
MTD	MOUNTED
NEC	NATIONAL ELECTRICAL CODE
NF	NON FUSED
NO.	NUMBER
OS	OCCUPANCY SENSOR
PH	PHASE
PIR	PASSIVE INFRARED
RGS	RIGID GALVANIZED STEEL
SM	SINGLE MODE
TTB	TELEPHONE TERMINAL BOARD
TV	TELEVISION
TVSS	TRANSIENT VOLTAGE SURGE SUPRESSOR
TX	TRANSFORMER
UNO	UNLESS NOTED OTHERWISE
V	VOLT
VA	VOLTAMPERE
VVD	VARIABLE VOLUME DAMPER
W	WATTS
WP	WATER PROOF
XFMR	TRANSFORMER

1

US Army Corps of Engineers ®
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

DESIGN BY: PFW
DRAWN BY: PFW
SBMT BY: SLO
CKD BY: SLO
PLOT DATE: 4/15/2015 10:00:30
PLOT SCALE: 1/2" = 1'-0"
SIZE: 22" x 34"
ISSUE DATE: 03-22-2015
SOLICITATION NO.: W91128F-15-B-0007
CONTRACT NO.: -
FILE NUMBER: AK 761-134-161
FILE NAME: FCXFPA001.DWG

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

LEGEND AND ABBREVIATIONS

SHEET IDENTIFICATION
FA111

ELECTRICAL FA111-

KEYED NOTES:

1. FIRE ALARM HORN STROBE, AND NOTIFICATION LIGHT. STROBE SHALL BE CLEAR ON HORN STROBE. DEVICE SHALL BE LABELED "ALERT". MOUNT AT HEIGHTS AS SPECIFIED IN NFPA 72.

2. FIRE NOTIFICATION DEVICE & MASS NOTIFICATION DEVICES SHALL BE MOUNTED AT ALL ASSEMBLY LOCATIONS. SEE SHEET FA602 FOR SOUND & VISUAL REQUIREMENTS.

3. INSTALL SINGLE STATION UNIT SMOKE/CO DETECTORS AS REQUIRED BY NFPA 101 9.6.2.10.8. TYPICAL OF ALL UNITS

4. CEILING MOUNTED FIRE AND MASS NOTIFICATION DEVICE FOR ALL UNITS, TYPICAL.

5. FIRE ALARM CONTROL PANEL WITH MASS NOTIFICATION, SEE FA501 & FA601 FOR FURTHER INFORMATION. CONNECT TO BASE FIRE ALARM LOOP.

6. FIRE ALARM ANNUNCIATOR AND MASS NOTIFICATION LOCAL OPERATING CONSOLE PANEL. INSTALL PER MANUFACTURERS REQUIREMENTS.

7. LOCATION OF FIRE DEPARTMENT HOOK-UP. COORDINATE FINAL LOCATION WITH ALL CRAFTS.

8. LOCATION OF TAMPER AND FLOW SWITCHES.

9. PIV, COORDINATE WITH CRAFTS FOR FINAL LOCATION.

10. DUCT DETECTOR, COORDINATE WITH MECHANICAL.

1 / FA121 — FIRE ALARM COMPOSITE PLAN

1/4" = 1'-0"

ELECTRICAL FA121-

US Army Corps of Engineers ®
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

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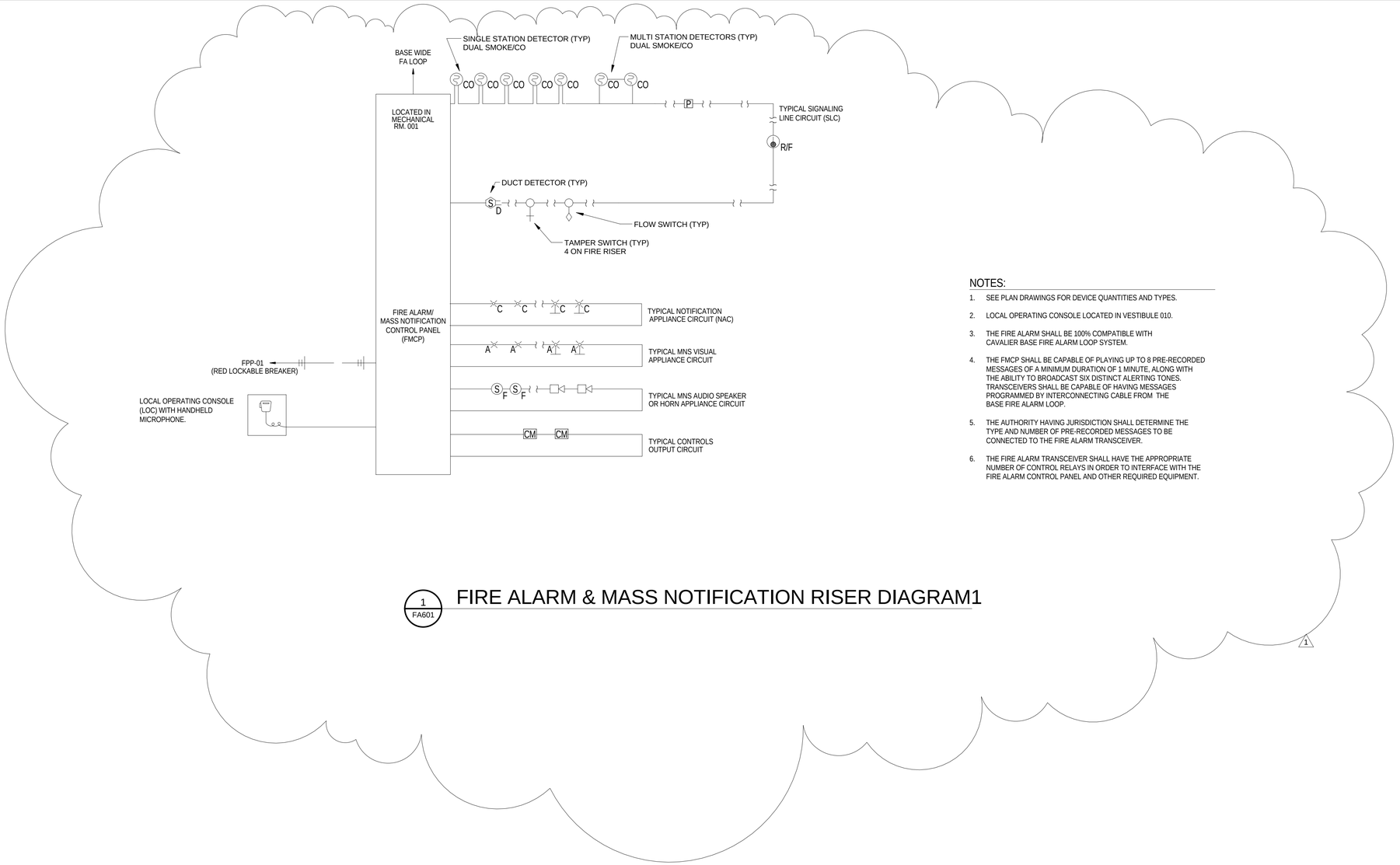
FILE NAME: N022-DORM-CVLR-RVT

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

FIRE ALARM PLAN

SHEET IDENTIFICATION
FA121



NOTES:

1. SEE PLAN DRAWINGS FOR DEVICE QUANTITIES AND TYPES.
2. LOCAL OPERATING CONSOLE LOCATED IN VESTIBULE 010.
3. THE FIRE ALARM SHALL BE 100% COMPATIBLE WITH CAVALIER BASE FIRE ALARM LOOP SYSTEM.
4. THE FMCP SHALL BE CAPABLE OF PLAYING UP TO 8 PRE-RECORDED MESSAGES OF A MINIMUM DURATION OF 1 MINUTE, ALONG WITH THE ABILITY TO BROADCAST SIX DISTINCT ALERTING TONES. TRANSCEIVERS SHALL BE CAPABLE OF HAVING MESSAGES PROGRAMMED BY INTERCONNECTING CABLE FROM THE BASE FIRE ALARM LOOP.
5. THE AUTHORITY HAVING JURISDICTION SHALL DETERMINE THE TYPE AND NUMBER OF PRE-RECORDED MESSAGES TO BE CONNECTED TO THE FIRE ALARM TRANSCEIVER.
6. THE FIRE ALARM TRANSCEIVER SHALL HAVE THE APPROPRIATE NUMBER OF CONTROL RELAYS IN ORDER TO INTERFACE WITH THE FIRE ALARM CONTROL PANEL AND OTHER REQUIRED EQUIPMENT.

1 FA601 FIRE ALARM & MASS NOTIFICATION RISER DIAGRAM1

1

US Army Corps of Engineers ®
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

DESIGN BY: PFW
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PLOT SCALE: 2.00 '= 1 '
SIZE: 22" x 34"
ISSUE DATE: 03-23-2015
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.: -
FILE NUMBER: #47F613-5401
FILE NAME: N22-DORM-CVLR-RVT

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

FIRE ALARM & MASS NOTIFICATION RISER

SHEET IDENTIFICATION
FA601

ELECTRICAL FA601-

		ANNUNICIATION					SYSTEM OUTPUTS																		
		BUILDING FACP/FMCP & FAA					TRANSMIT SIGNAL TO BASE FIRE ALARM LOOP								AUXILARY FUNCTIONS						NOTIFICATION APPLIANCES SIGNAL				
SYSTEM INPUTS		AUDIO-VISUAL FIRE ALARM INDICATION (COMMON)	AUDIO-VISUAL SUPERVISORY INDICATOR (COMMON)	AUDIO-VISUAL COMMON TROUBLE INDICATOR (COMMON)	TROUBLE INDICATOR FA MUTE FOR MNS ANNOUNCMENT AUDIO-VISUAL	AUDIO-VISUAL SUPERVISORY INDICATION FOR FA OVERRIDE BY MNS	COMMON FIRE ALARM SIGNAL (DEVICE)	SUPERVISORY SIGNAL BY DEVICE	WATERFLOW	GENERAL TROUBLE	FA MUTE FOR MNS ANNOUNCMENT (60 SECOND MAXIMUM)						FIRE ALARM OCCUPANT NOTIFICATION	FA VISUAL APPLIANCE CLEAR STROBE	ACTUATE MASS OCCUPANT NOTIFICATION AMBER STROBE	SOUNDER BASES WITHING ASSOCIATED UNIT	EXTERIOR MASS NOTIFICATION AUDIO	VISUAL FA TEMPORARY OVERIDE				
	FIRE ALARMS	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	MANUAL FIRE ALARM PULLSTATIONS	A					X													S	T						1
2	WATERFLOW INDICATOR SPRINKLERS	A					X													S	T			W			2
3	HEAT/CO DETECTOR ABOVE FACP/MECH ROOM, OR FAAP	A					X													S	T		V	W			3
4	SMOKE DETECTOR IN SLEEPING QUARTERS (SOUNDER BASE)		B					G																			4
5	DUCT SMOKE DETECTOR		B					G																			5
6	(RESERVED)																										6
7	(RESERVED)																										7
	SUPERVISORY SIGNALS																										
8	TAMPER SWITCH (S)		B					G																			8
9	MANUAL MNSW ACTIVATION AT FACP/LOC		B		D			G			J											U					9
10	CONCURRENT FAS & MNS ACTIVATION				D	E					J															Y	10
11	(RESERVED)																										11
12	(RESERVED)																										12
	TROUBLE CONDITIONS																										
13	CIRCUIT FAULT IDC OPEN			C						I																	13
14	CIRCUIT FAULT IDC SHORT			C						I																	14
15	CIRCUIT FAULT IDC GROUND			C						I																	15
16	CIRCUT FAULT NAC OPEN			C						I																	16
17	CIRCUIT FAULT NAC SHORT			C						I																	17
18	CIRCUIT FAULT NAC GROUND			C						I																	18
19	AC POWER FAILURE			C						I																	19
20	TEST MODE			C						I																	20
21	LOW BATTERY VOLTAGE			C						I																	21
22	(RESERVED)																										22

1

GENERAL NOTES:

1. PROVIDE MASS NOTIFICATION IN FIRE ALARM CONTROL PANEL FOR DORMITORY BUILDING.

2. COORDINATE ALL OUTPUTS WITH FIRE DEPARTMENT. INCLUDING INDIVIDUAL DEVICE ALARMS, ETC.

US Army Corps of Engineers ®
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

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CONTRACT NO.: -
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FILE NAME: ND22-DORM-CVLR-RVT

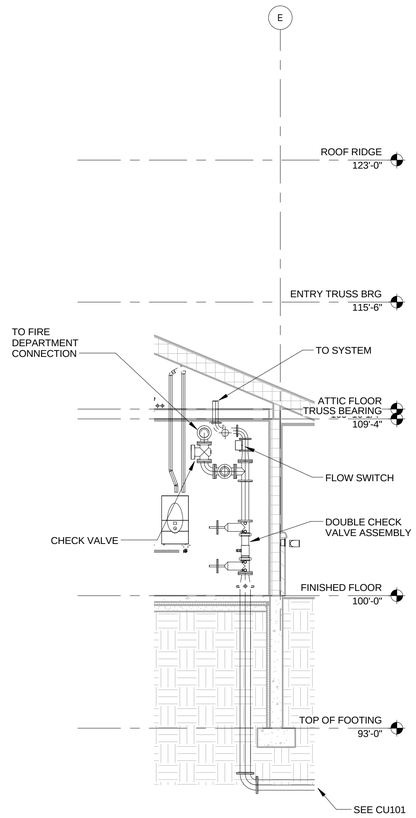
US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

FIRE ALARM & MASS NOTIFICATION RISER MATRIX

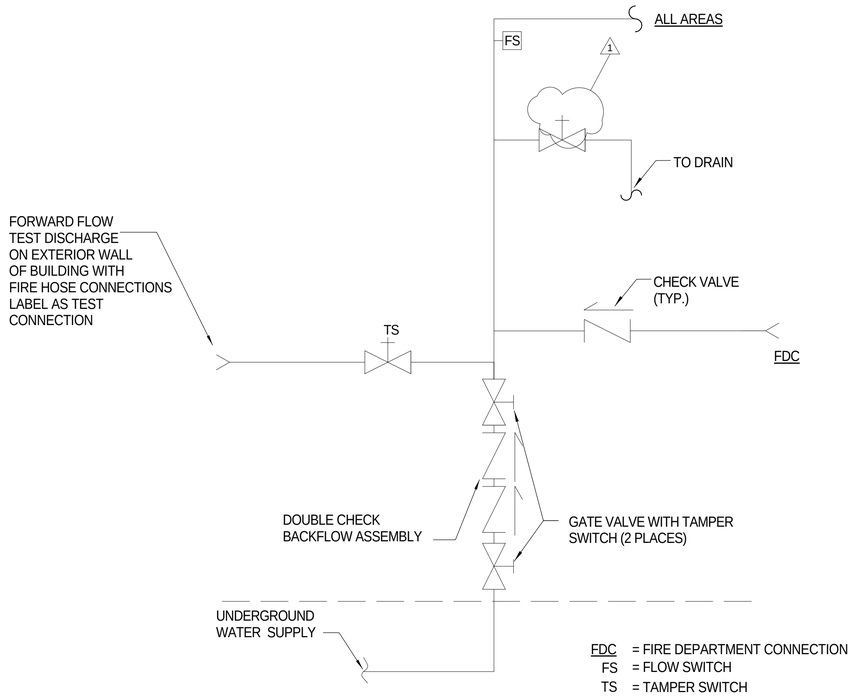
SHEET IDENTIFICATION
FA602

ELECTRICAL FA602-



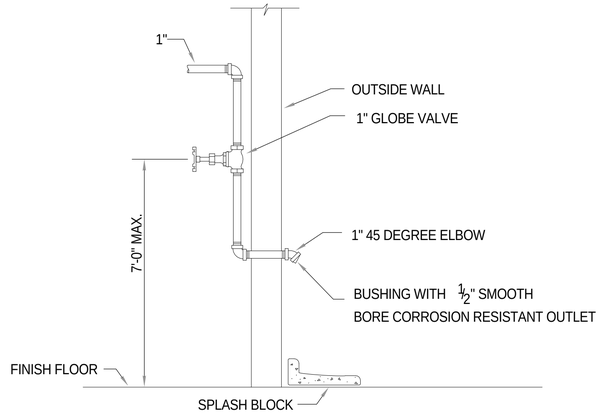
1 FX501 FIRE SPRINKLER RISER ELEVATION

1/4" = 1'-0"



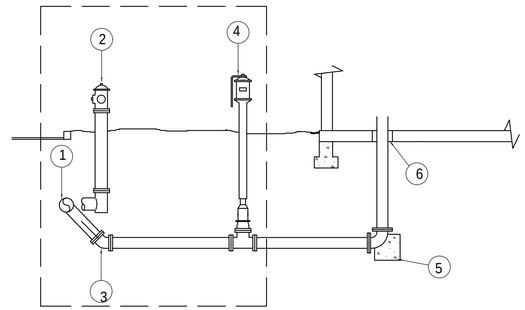
2 FX501 RISER DIAGRAM

N.T.S.



3 FX501 INSPECTOR'S TEST CONNECTION

N.T.S.



ITEM	DESCRIPTION
1	BASE MAIN
2	FIRE HYDRANT
3	FITTING (ELBOW)
4	POST INDICATOR VALVE WITH TAMPER SWITCH
5	THRUST BLOCK
6	PIPE SLEEVE (SHALL BE 2" AROUND PIPE)

4 FX501 FIRE SERVICE ENTRANCE

N.T.S.

US Army Corps of Engineers ®
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

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CKD BY: B.D.E.
SENT BY: M.T.S.
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FILE NAME:

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

FIRE PROTECTION DETAILS

SHEET IDENTIFICATION
FX501

FX501 -

PLUMBING FIXTURE SCHEDULE

TAG	DESCRIPTION	CW	HW	WASTE	VENT	MANUFACTURER	MODEL	REMARKS
WC-1	WATER CLOSET, TANK TYPE (ABA) - 1.28 GPF	3/4"	---	3"	2"	KOHLER	K-3999-T	1
WC-2	WATER CLOSET, TANK TYPE - 1.28 GPF	3/4"	---	3"	2"	KOHLER	K-3998-T	1
WC-3	WATER CLOSET, FLOOR MOUNTED FLUSH VALVE (ABA) - 1.28 GPF	1"	---	3"	2"	KOHLER	K-4405	2
L-1	LAVATORY (ABA) - 21" X 18" - 0.35 GPM	1/2"	1/2"	1 1/4"	1 1/4"	KOHLER	K-2005	3, 14 — 1
L-2	LAVATORY - 19" DIAMETER - 0.35 GPM	1/2"	1/2"	1 1/4"	1 1/4"	KOHLER	K-2917-4	3
L-3	LAVATORY - 21" X 18"- 0.5 GPM	1/2"	1/2"	1 1/4"	1 1/4"	KOHLER	K-2005	4, 14 — 1
SH-1	SHOWER HEAD & ACCESSORIES (ABA) - 1.5 GPM	1/2"	1/2"	2	1 1/2"	DELTA	T13H332	12
SH-2	SHOWER HEAD & ACCESSORIES - 1.5 GPM	1/2"	1/2"	2	1 1/2"	DELTA	T13H132	12
SD	SHOWER DRAIN	---	---	2"	2"	WATTS	SD-PB	---
SK-1	DOUBLE COMPARTMENT SINK - 25 X 19 1/2 X 7 5/8" DEEP - 1.0 GPM	1/2"	1/2"	1 1/2"	1 1/2"	ELKAY	LRQ2519	5
SK-2	SINGLE COMPARMENT SINK - 19 1/2 X 22 X 10 1/8 DEEP - 1.0 GPM	1/2"	1/2"	1 1/2"	1 1/2"	ELKAY	DLR202210	6
SS-1	STAINLESS STEEL SERVICE SINK - 24" X 24"	3/4"	3/4"	3"	1 1/2"	GRIFFIN	LT-118	7
WB-1	WASHING MACHINE OUTLET BOX	1/2"	1/2"	2	1 1/2"	GUY GRAY	WB200	11
IMB	ICE MAKER OUTLET BOX	1/2"	---	---	---	GUY GRAY	FR-12	11
FD-1	FLOOR DRAIN	---	---	SEE DWGS	SEE DWGS	WATTS	FD-100-FC	8
FD-2	HEAVY DUTY FLOOR DRAIN	---	---	SEE DWGS	SEE DWGS	WATTS	FD-100-L6	8
FD-3	VESTIBULE FLOOR DRAIN	---	---	SEE DWGS	SEE DWGS	WATTS	FD-100-FC	13
FPWH	FREEZEPROOF WALL HYDRANT	3/4"	---	---	---	WOODFORD	B67	9
HB	HOSE BIBB	3/4"	---	---	---	WOODFORD	24	10
TP-1	TAIL PIECE TRAP PRIMER CONNECTION	1/2"	---	---	---	PPP	LTP-1500	---
TP-2	WATER SUPPLY TRAP PRIMER CONNECTION	1/2"	---	---	---	PPP	CPO-500	---
FCO	FLOOR CLEANOUT	---	---	SEE DWGS	---	WATTS	CO-200-R	---
WCO	WALL CLEANOUT	---	---	SEE DWGS	---	WATTS	CO-590-RD	---

1. PROVIDE WITH KOHLER K-4636 ELONGATED SEAT COVER WITH LID. SUPPLY WITH STAINLESS STEEL WATER SUPPLY HOSE.
2. INSTALL WATER CLOSET WITH KOHLER K-4670-CA OPEN FRONT SEAT LESS COVER AND SLOAN MODEL 111-1.28 ES-S TMO HARD-WIRED FLUSH VALVE. SUPPLY WITH STAINLESS STEEL WATER SUPPLY HOSE.
3. PROVIDE AND INSTALL LAVATORY WITH TWO-HANDLE CENTERSET LAVATORY FAUCET - MOEN MODEL 8800F03 WITH FLOW RATE OF 0.35 GPM.
4. PROVIDE AND INSTALL LAVATORY WITH DELTA MODEL 590-LGHGMHDF WITH RP31816 WITH DECORATIVE COVER PLATE & GASKET HARDWIRED FAUCET.
5. PROVIDE AND INSTALL SINK WITH KITCHEN FAUCET - DELTA MODEL NO. DELTA 400LF-HDF WITH A 1.0 GPM AERATOR AND A STAINLESS STEEL DRAIN OUTLET. ALSO PROVIDE AND INSTALL A 3/4" GARBAGE DISPOSAL INSINKERATOR EVOLUTION SERIES.
6. SUPPLY SINGLE COMPARTMENT SINK WITH FAUCET - DELTA MODEL NO. 100LF-HDF WITH A 1.0 GPM AERATOR.
7. PROVIDE AND INSTALL SERVICE SINK WITH GRIFFIN MODEL FG-105, 5" GOOSENECK FAUCET.
8. PROVIDE FLOOR DRAIN WITH TRAP PRIMER DEVICE.
9. MOUNT WALL HYDRANT AT 24" ABOVE FINISHED GRADE
10. PROVIDE HOSE BIBB WITH OPTIONAL WHEEL HANDLE.
11. PROVIDE WITH 1/2" STAINLESS STEEL SUPPLY HOSE(S).
12. PROVIDE SHOWER VALVE WITH INTEGRAL SHUTOFF VALVE ACCESSIBLE BEHIND THE COVER PLATE.
13. PROVIDE FLOOR DRAIN WITH A TRAP GUARD DRAIN INSERT SIMILAR TO PRO SET TRAP GUARD MODEL TG34IP.
14. PROVIDE AND INSTALL LAVATORY WITH ABA PIPE WRAP KIT SIMILAR TO TRUEBRO 102 E-Z.

THERMOSTATIC MIXING VALVE SCHEDULE

MARK	SERVICE	LOCATION	WATER TEMPERATURE			MIN. GPM	MAX. GPM	MANUFACTURER	MODEL
			HOT WATER	COLD WATER	FINAL MIXED				
MV-1	DOMESTIC HOT WATER	UTILITIES 001	140	50	110	1/2	103	LAWLER	802

GAS FIRED WATER HEATER SCHEDULE

MARK	LOCATION	CAPACITY	RECOVERY AT 100 DEG. F. RISE	NATURAL GAS INPUT BTUH	MANUFACTURER & MODEL NUMBER	REMARKS
GWH -1	UTILITIES - 001	100 GALLONS	238 GPH	199,000	LOCHINVAR TNR200-100	1

1. PROVIDE AND INSTALL CONCENTRIC VENT KIT.
2. WATER HEATER TO HAVE UP TO 98% THERMAL EFFICIENCY, LOW NOX OPERATION AND SEALED COMBUSTION.

RECIRCULATION PUMP SCHEDULE

MARK	SERVICE	DRIVE TYPE	FLOW RATE (GPM)	PUMP HEAD	HORSEPOWER	RPM	VOLTAGE	MANUFACTURER	MODEL	REMARKS
RCP-1	DOMESTIC WATER	INLINE	1	7	1/12	2,650	115V/1P	BELL & GOSSETT	SERIES PL-30	1

1. RCP-1 TO OPERATE OFF AQUASTAT TO MAINTAIN LOOP TEMPERATURE.

EXPANSION TANK SCHEDULE

MARK	TYPE	SYSTEM	TANK VOLUME (GAL)	DIAMETER (IN)	HEIGHT (IN)	MAX DESIGN TEMP (DEG. F.)	MAX DESIGN PRESSURE (PSI)	BASIS OF DESIGN		REMARKS
								MFR	MODEL	
ET-1	BLADDER	DOMESTIC	10	12	25	140	125	WESSELS	TXA 35	1, 2

1. PRE-CHARGED WITH BOTTOM SYSTEM CONNECTION AND CHARGING VALVE CONNECTION.
2. CONSTRUCTED WITH REPLACEABLE FAC APPROVED BUTYL BLADDER.

BACKFLOW PREVENTER (BFP) SCHEDULE

MARK	TYPE	LOCATION	SERVES	SIZE (IN)	DESIGN FLOW (GPM)	PRESSURE DROP (PSI)	MANUFACTURER	MODEL	REMARKS
BFP	RPZ	MECHANICAL ROOM 120	DCW	2 1/2"	78.0 GPM	15 PSI	WATTS	909	1, 2

1. PROVIDE WITH OSY SHUT-OFF VALVES.
2. DRAIN WITH AIR GAP TO FLOOR DRAIN BELOW ASSEMBLY.

NOTE:

WHERE THE MANUFACTURER AND/OR MODEL NUMBER IS LISTED, IT IS INTENDED TO INDICATE THE "BASIS OF DESIGN" ONLY. IT IS NOT INTENDED TO LIMIT THE EQUIPMENT PROVIDED TO THAT INDICATED IN THE SCHEDULE. OTHER MANUFACTURERS OR MODELS OF EQUIPMENT MAY BE PROVIDED. ALL EQUIPMENT PROVIDED SHALL MET THE REQUIREMENTS OF THE APPLICABLE SCHEDULE AND SPECIFICATIONS.

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OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

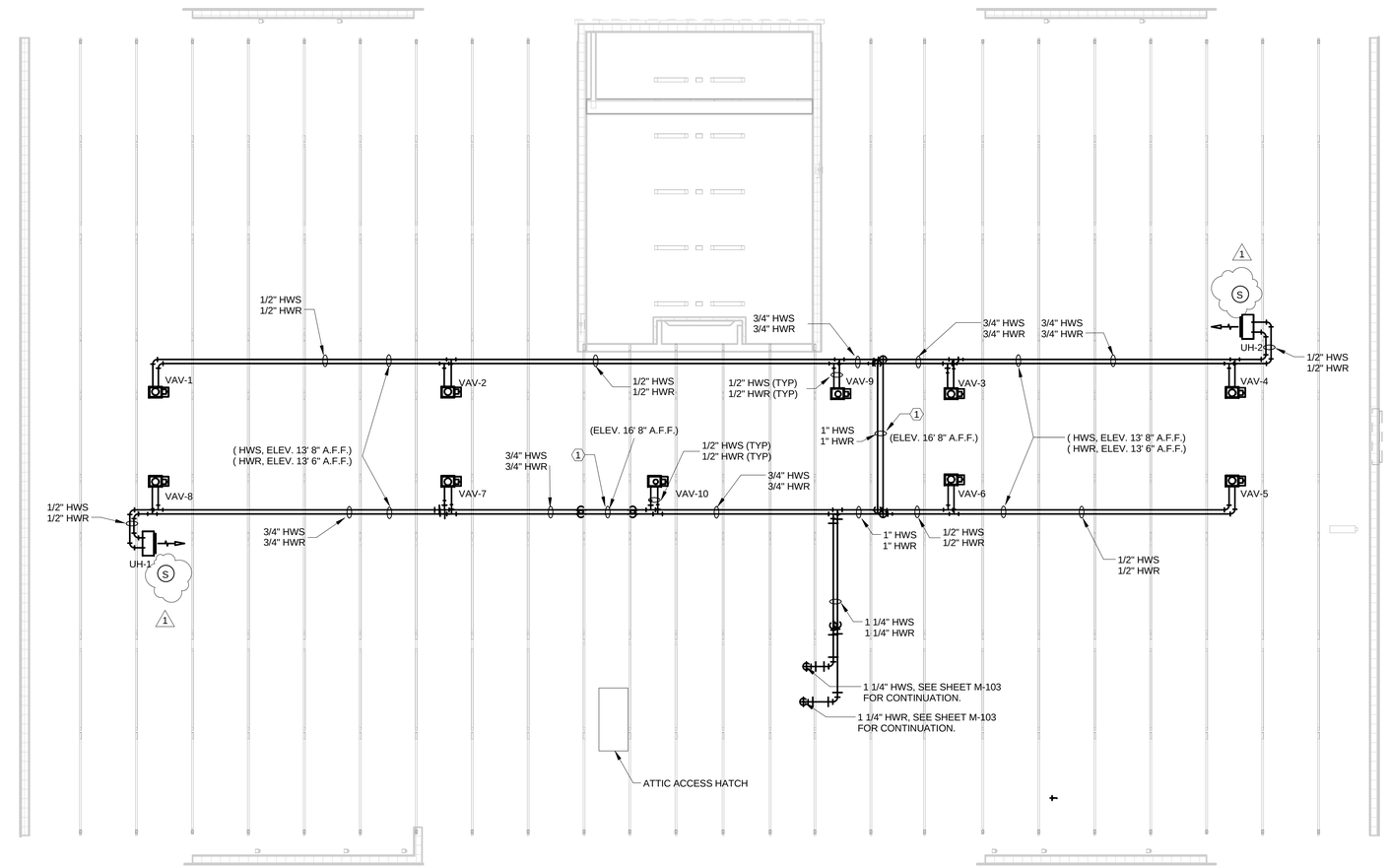
ISSUE DATE: 03-23-2015
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.: -
FILE NUMBER: #47612-34-041
DESIGN BY: M.L.H.
DRAWN BY: M.L.H.
CKD BY: M.T.S.
SBMT BY: M.T.S.
PLOT DATE: 4/14/2015 4:51:59 PM
PLOT SCALE: 1
FILE NAME:
SIZE: 22" x 34"

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

PLUMBING SCHEDULES

SHEET IDENTIFICATION
P-600



ATTIC/CLERESTORY MECHANICAL HYDRONIC PIPING PLAN

1 / M-104

3/16" = 1'-0"

GENERAL NOTES:

1. ALL HYDRONIC PIPING CONNECTIONS TO HVAC EQUIPMENT SHALL BE SIZED TO MEET MANUFACTURER'S CONNECTIONS.

MECHANICAL KEYNOTES:

(1) RISE PIPING UP AND OVER ATTIC WALK-WAY. MAINTAIN MIN. CLEARANCE 6' 6" FROM FINISHED ATTIC FLOOR.

PLAN NORTH

0 4' 8' 12'

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OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

DESIGN BY: KP
DRAWN BY: KP
SBMT BY: MTS
CKD BY: MTS
PLOT SCALE: 3/16" = 1'-0"
SIZE: 22" x 34"
ISSUE DATE: 03-23-2015
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.: -
PLOT DATE: 4/10/2015 3:39:58 PM
FILE NUMBER: R:\751-134-1-01
FILE NAME:

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OMAHA DISTRICT
OMAHA, NEBRASKA

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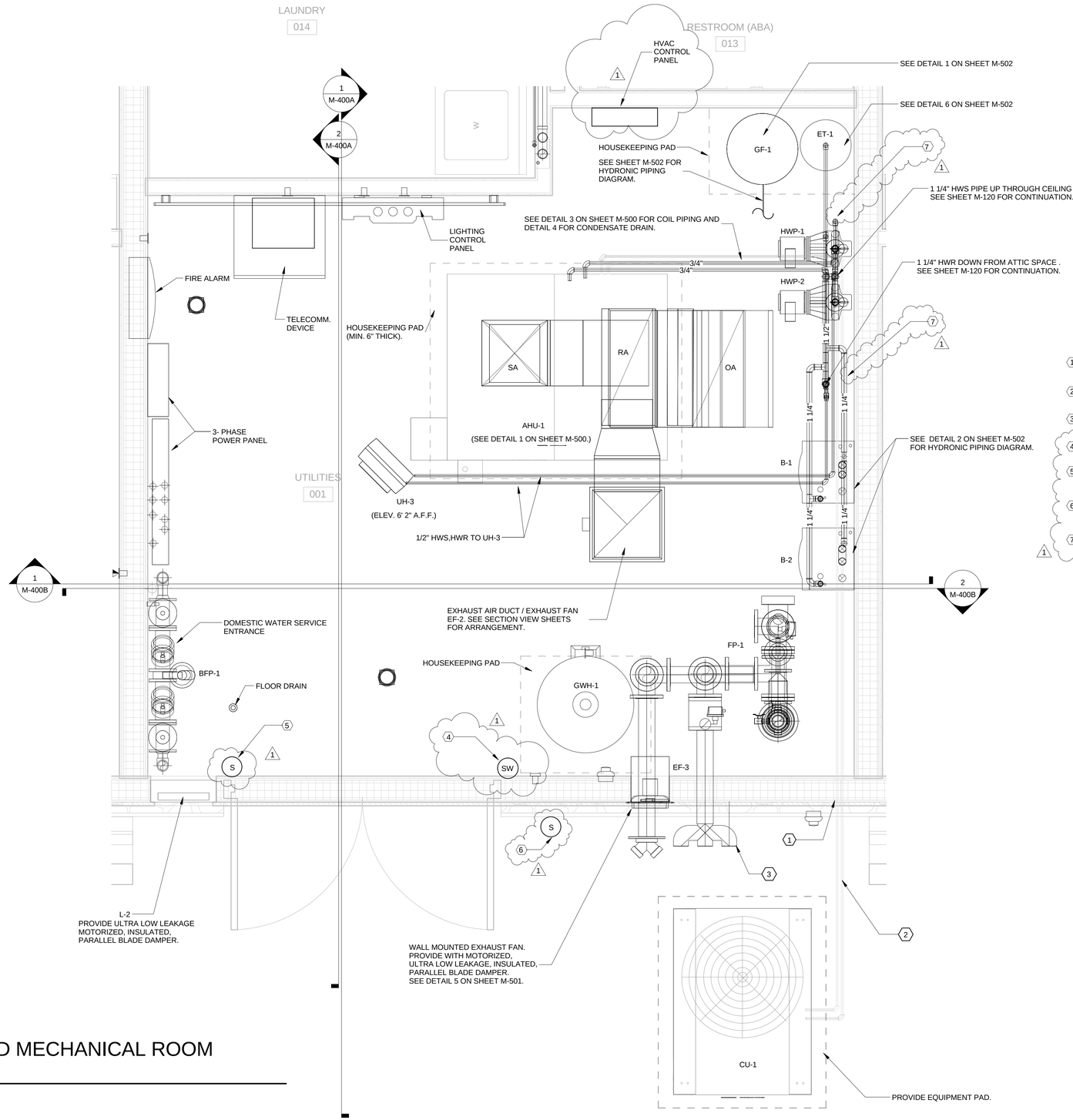
CAVALIER AFS, ND.

ATTIC/CLERESTORY MECHANICAL HYDRONIC PIPING PLAN

SHEET IDENTIFICATION
M-104

M-104-



MECHANICAL KEYNOTES:

1. SEAL PIPE PENETRATION THROUGH WALL WATERTIGHT.
2. SUPPORT REFRIGERANT LINE AT APPROXIMATE MIDPOINT BETWEEN WALL AND CU-1.
3. SPRINKLER SYSTEM FORWARD FLOW TEST CONNECTION.
4. BOILER EMERGENCY SHUTDOWN SWITCH. SEE SPECIFICATION 23 52 00.
5. WALL MOUNTED TEMPERATURE SENSOR. INSTALL ON THE THERMAL ISOLATION BASE. PROVIDE INPUT TO DDC SYSTEM.
6. OUTSIDE AIR TEMPERATURE SENSOR. PROVIDE WITH SUNSHIELD. PROVIDE INPUT TO THE DDC SYSTEM.
7. APPROXIMATE LOCATION OF ELECTRICAL DISCONNECTS. SEE ELECTRICAL PLANS.

PLAN NORTH

0 1' 2' 3'

ENLARGED MECHANICAL ROOM PLAN

1 / M-400

3/4" = 1'-0"

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OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

ISSUE DATE: 03-22-2015
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.: -
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SIZE: 22" x 34"
FILE NAME:

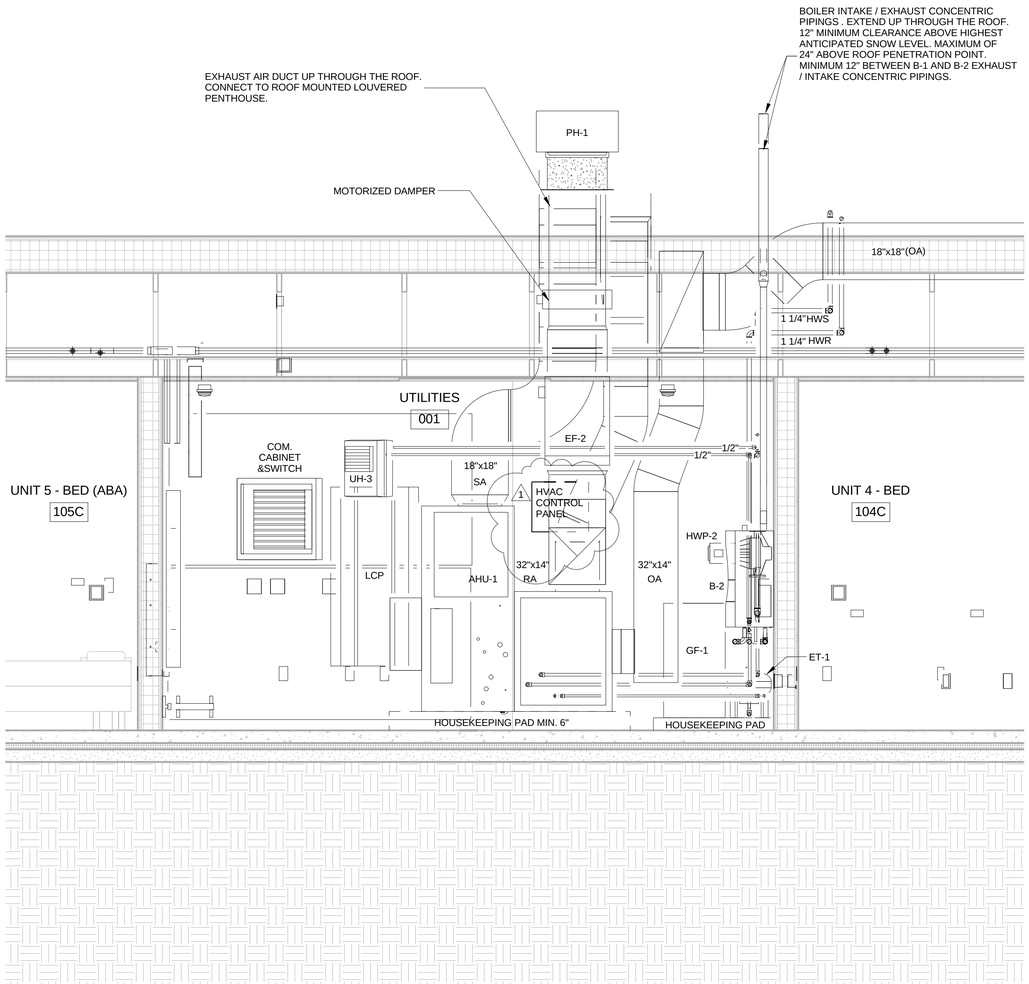
US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

ENLARGED MECHANICAL ROOM PLAN

SHEET IDENTIFICATION
M-400

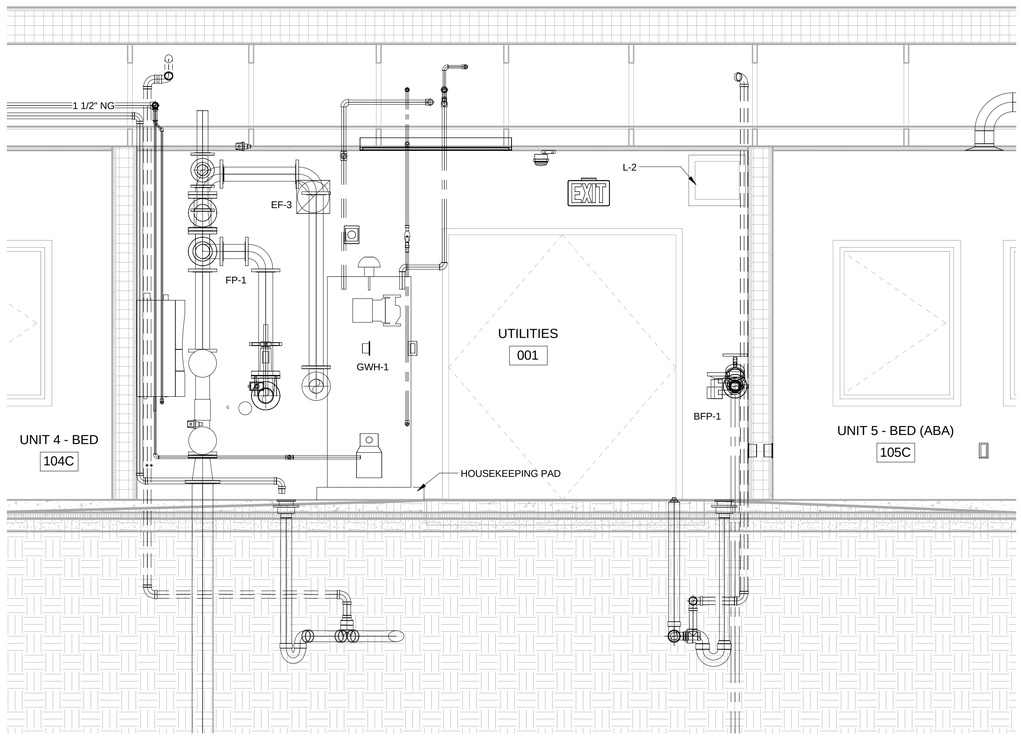
M-400-



1 M-400B

M400B/SECTION3

1/2" = 1'-0"



2 M-400B

M400B/SECTION4

1/2" = 1'-0"

0 1' 2' 4'

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MARK	DESCRIPTION	DATE	APPR.
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

ISSUE DATE: 03-22-2015
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.: -
FILE NUMBER: AF251.134.451
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CKD BY: MTS
SBMT BY: MTS
PLOT DATE: 4/10/2015 3:48:05 PM
PLOT SCALE: 1/2" = 1'-0"
SIZE: 22" x 34"
FILE NAME:

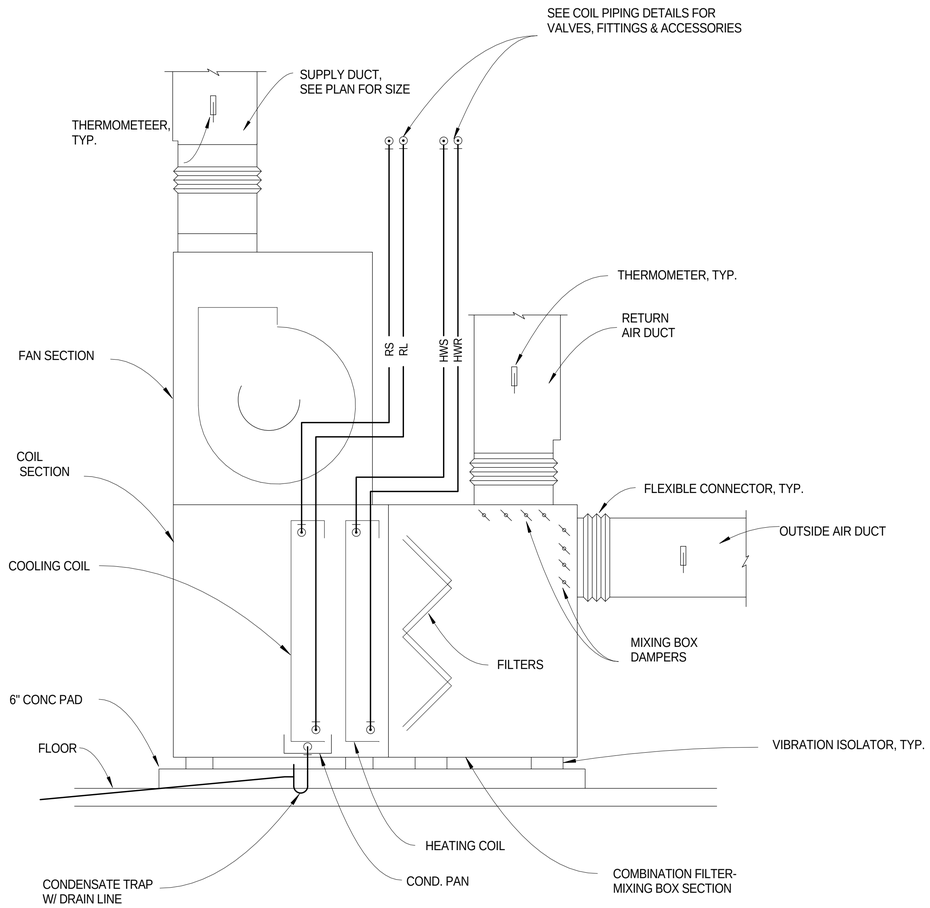
US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

SECTION VIEW 3, 4

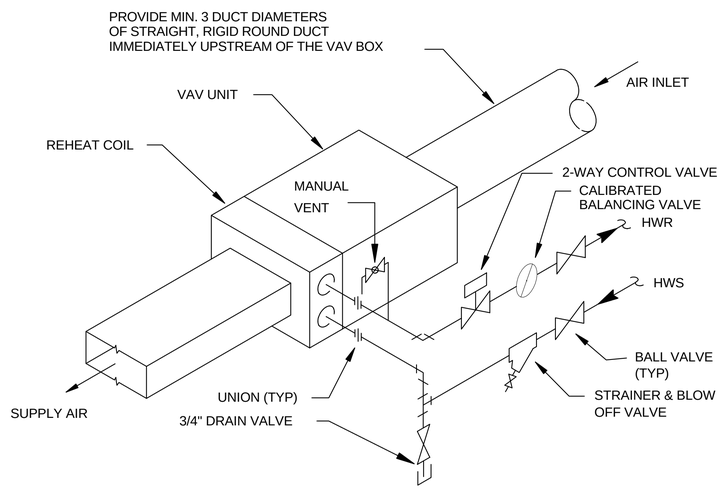
SHEET IDENTIFICATION
M-400B

M-400B-



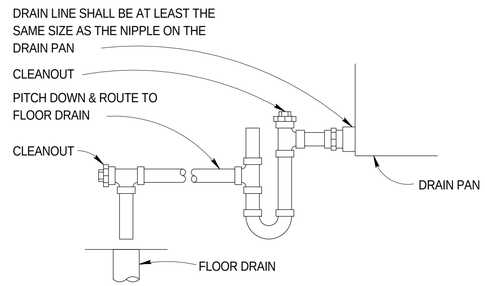
1 M-500 AIR HANDLING UNIT DETAIL (VERTICAL)

N.T.S.



2 M-500 VAV UNIT WITH REHEAT COIL DETAIL

N.T.S.



4 M-500 AIR HANDLING UNIT DRAIN TRAP DETAIL

N.T.S.

3 M-500 COIL PIPING DETAIL _ 3-WAY CONTROL VALVE

N.T.S.

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MARK	DESCRIPTION	DATE	APPR
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

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SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.: -
FILE NUMBER: #47613A41
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SIZE: 22" x 34"
FILE NAME:

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

MECHANICAL DETAILS-1

SHEET IDENTIFICATION
M-500

M-500-

GLYCOL FEEDER SCHEDULE

TAG	MANUFACTURER / MODEL NO.	SYSTEM	VOLUME (GAL)	% GLYCOL	REMARKS
GF-1	NEPTUNE G-50-2A	HEATING	50	50	1,2,3,4,5

REMARKS:
1. 50 GALLON POLYETHYLENE TANK MOUNTED ON FACTORY-FABRICATED METAL STAND/ FRAME.
2. FLOAT SWITCH FOR LOW-LEVEL PUMP SHUTOFF & ALARM CONTACTS.
3. PUMP "ON" INDICATOR LIGHT & CONTACTS FOR CONNECTION TO BAS FOR PUMP STATUS AND LOW-LEVEL ALARM.
4. PROVIDE POWER CORD AND SINGLE-POINT ELECTRICAL CONNECTION.
5. 50% PROPYLENE GLYCOL-WATER SOLUTION FOR HEATING SYSTEM. FILL TANK WITH SOLUTION AFTER PIPING SYSTEM HAS BEEN FILLED. USE ALUMINUM-SAFE PROPYLENE GLYCOL.

AIR SEPARATOR SCHEDULE

TAG	TYPE	SYSTEM	FLOW (GPM)	DESIGN PRESS. (PSIG)	MAX PRESS. DROP (FT / WG)	MANUFACTURER / MODEL	REMARK
AS-1	ASME	HEATING SYSTEM	25	125	0.5	AMTROL / 2-AS	1

REMARKS:
1. AIR AND DIRT SEPARATOR WITH STRAINER, AUTOMATIC AIR VENT AND BLOW-DOWN VALVE.

HOT WATER UNIT HEATER SCHEDULE

TAG	LOCATION	CAPACITY (BTU/HR)	AIR FLOW (CFM)	FLOW (GPM)	MAX. PRESSURE DROP (FT.WG)	ENTERING AIR TEMP (°F)	MOUNTING ORIENTATION	MANUFACTURER / MODEL NO.	REMARKS
UH-1	ATTIC SPACE	15,000	500	1.9	2.2	40	HORIZONTAL	TRANE / UHSBA18	1,2,3,4,5
UH-2	ATTIC SPACE	15,000	500	1.9	2.2	40	HORIZONTAL	TRANE / UHSBA18	1,2,3,4,5
UH-3	UTILITY-001	7,000	245	0.8	0.8	40	HORIZONTAL	TRANE / UHSBA08	1,2,3,4,5

REMARKS:
1. CAPACITY BASED ON 160 °F SUPPLY WATER TEMP WITH A MAXIMUM 20 DEGREE TEMPERATURE DROP. WATER CONTAINS 50% PROPYLENE GLYCOL.
2. PROVIDE HORIZONTAL FIN DIFFUSER, MOUNTING BRACKETS AND HARDWARE.
3. PROVIDE THERMAL OVERLOAD AND DISCONNECT SWITCH.
4. PROVIDE WITH WALL MOUNTED TEMPERATURE SENSOR PROVIDE INPUT TO BUILDING HVAC CONTROL SYSTEM. 1
5. UNIT SHALL TURN ON AT 40 °F AND TURN OFF AT 45°F.

BOILER SCHEDULE

TAG	MANUFACTURER / MODEL	INPUT CAPACITY(BTU/H)	WATER TEMP IN / OUT (°F)	EFFICIENCY (%)	FUEL	REMARKS
B-1	-	110,000	160 / 140	90	NATURAL GAS	1, 2, 3, 4
B-2	-	110,000	160 / 140	90	NATURAL GAS	1, 2, 3, 4

REMARKS:
1. FLUID IS 50% PROPYLENE GLYCOL-WATER SOLUTION.
2. PROVIDE BOILER CIRCULATING PUMP WHEN BOILER IS NOT EQUIPPED WITH INTEGRATED PUMP.
3. PROVIDE BOILER WITH MINIMUM EFFICIENCY OF 90% AT 140 DEGREE F RETURN WATER TEMPERATURE.
4. PROVIDE PLANT MASTER CONTROLLER FOR OPTIMIZED CONTROL OF BOILERS.

EXPANSION TANK SCHEDULE

TAG	DESCRIPTION	SYSTEM	TANK VOLUME (GAL)	ACCEPTANCE VOLUME (GAL)	MANUFACTURER / MODEL NO.	REMARKS
ET-1	BLADDER	HEATING SYSTEM	4	2.5	TACO / CBX15	1

REMARKS:
1. VERTICAL EXPANSION TANK FOR FLOOR MOUNTING, REMOVABLE BLADDER.

PUMP SCHEDULE

TAG	MANUFACTURER / MODEL	TYPE	SERVICE	FLOW (GPM)	HEAD (FT)	HP	REMARKS
HWP-1	BELL & GOSSETT / 1AAB E-90	IN-LINE CENTRIFUGAL	HYDRONIC HEATING SYSTEM	25	25	0.5	1,2
HWP-2	BELL & GOSSETT / 1AAB E-90	IN-LINE CENTRIFUGAL	HYDRONIC HEATING SYSTEM	25	25	0.5	1,2

REMARKS:
1. FLUID IS 50% PROPYLENE GLYCOL-WATER SOLUTION.
2. SEE SHEET M-502 FOR TYPICAL HYDRONIC PIPING DIAGRAM.

ELECTRIC BASE BOARD HEATER SCHEDULE

TAG	LOCATION	CAPACITY (BTU/HR)	VOLTS	WATTS	AMPS	MANUFACTURER / MODEL NO.	REMARKS
BH-1	VEST. (N)	3413 /2567	240 / 208	1000/752	4.2/3.6	BERKO / BKOC2544W	1, 2
BH-2	VEST. (E)	1706 /1283	240 / 208	500 / 376	2.1 / 1.8	BERKO / BKOC25426W	1, 2
BH-3	VEST. (W)	1706 /1283	240 / 208	500 / 376	2.1 / 1.8	BERKO / BKOC25426W	1, 2

REMARKS:
1. PROVIDE WITH WALL MOUNTED TEMPERATURE SENSOR. 1
2. UNIT SHALL TURN ON AT 48 °F AND TURN OFF AT 52°F.

MECHANICAL NOTES:

1. WHERE THE MANUFACTURER AND/OR MODEL NUMBER IS LISTED, IT IS INTENDED TO INDICATE THE "BASIS OF DESIGN" ONLY. IT IS NOT INTENDED TO LIMIT THE EQUIPMENT PROVIDED TO THAT INDICATED IN THE SCHEDULE. OTHER MANUFACTURERS OR MODELS OF EQUIPMENT MAY BE PROVIDED. ALL EQUIPMENT PROVIDED SHALL MEET THE REQUIREMENTS OF THE APPLICABLE SCHEDULE AND SPECIFICATIONS.

US Army Corps of Engineers ®
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

ISSUE DATE: 03-23-2015
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.: -
FILE NUMBER: 447213A401
DESIGN BY: KP
DRAWN BY: KP
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SBMT BY: MTS
PLOT DATE: 4/15/2015 12:39:39 PM
PLOT SCALE: 1:1.5
FILE NAME:
SIZE: 22" x 34"

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

MECHANICAL SCHEDULE-2

SHEET IDENTIFICATION
M-601

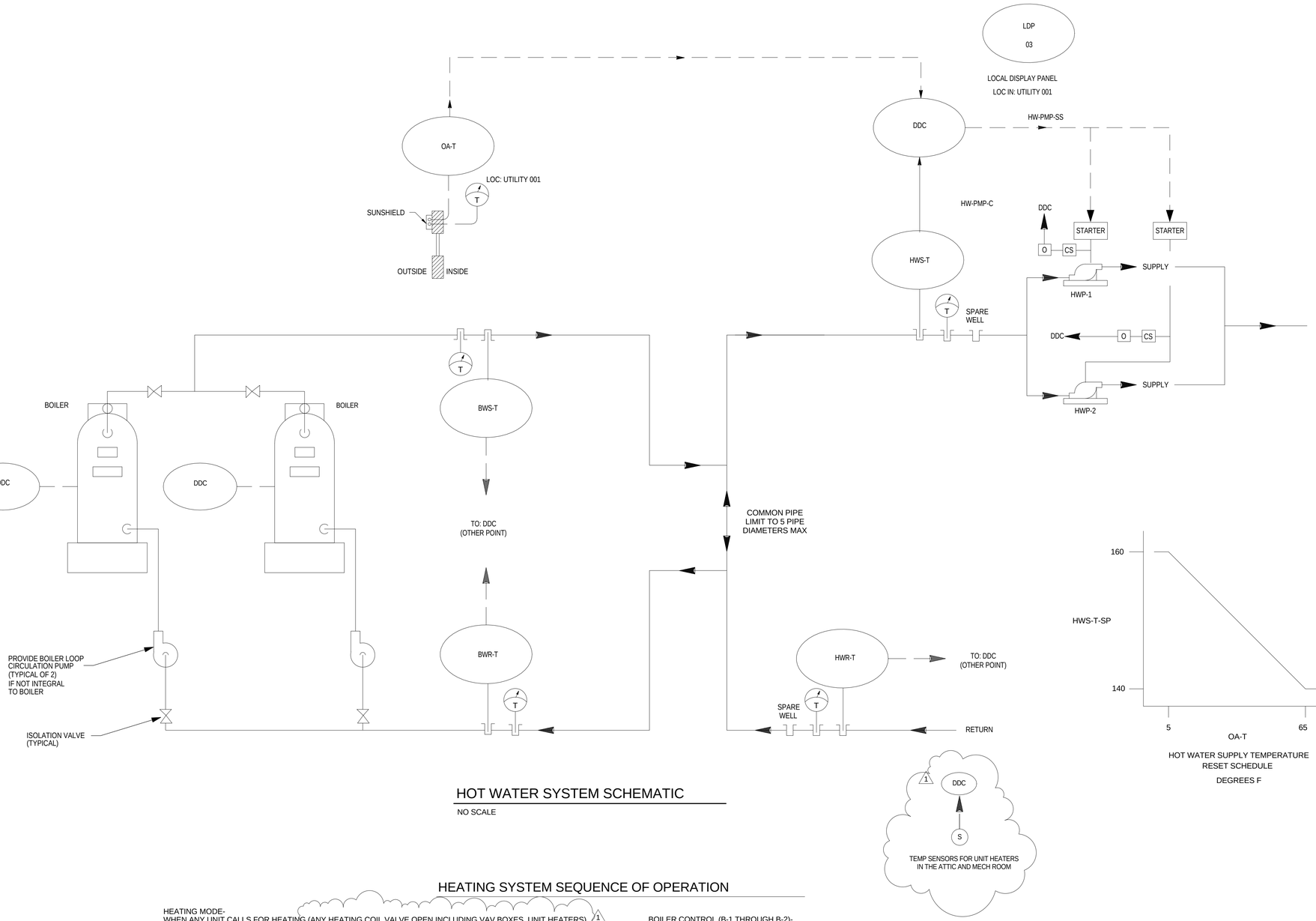
ABBREVIATIONS	
VFD	VARIABLE FREQUENCY DRIVE
PB	PROPORTIONAL BAND
DA	DIRECT ACTING
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
C	COMMON
OA	OUTSIDE AIR
R	RELAY
☐	DTC TERMINAL
	TERMINAL
○	MOUNT IN/ON CONTROL PANEL
■	MOUNT IN SPACE
S/S	START/STOP
ASC	APPLICATION SPECIFIC CONTROLLER
FM	FLOW METER
MS	MOTOR STARTER
CB	CIRCUIT BREAKER
OL	OVERLOAD
DS	DISCONNECT SWITCH (SEE ELEC PLANS)
(E)	EXISTING
XFMR	TRANSFORMER

CONTROL DEVICE SYMBOLS	
CS	CURRENT SENSOR
D#	CONTROL DAMPER
DPS	DIFFERENTIAL PRESSURE SWITCH
DPT	DIFFERENTIAL PRESSURE TRANSDUCER
ES	END SWITCH
LS	LEVEL SWITCH
FS#	FLOW SWITCH
MD	MOTORIZED DAMPER
MV	MOTORIZED VALVE
PS	PRESSURE SWITCH
SD	SMOKE DETECTOR
STR	MOTOR STARTER

EMCS INPUT/OUTPUT SYMBOLS	
☐ →EMCS	SIGNAL TRANSMITTED TO EMCS
☐ ←EMCS	SIGNAL TRANSMITTED FROM EMCS
A	ALARM CONTACT SIGNAL
C	CONDUCTIVITY
F	FLOW INDICATION
FF	FLAME FAILURE
LV	LOW LEVEL INDICATION
O	ON-OFF STATUS SIGNAL
P	PRESSURE INDICATION
PC	POSITION CONTROL
R	RESET SIGNAL
S	START STOP INTERFACE
SC	SPEED CONTROL
T	TEMPERATURE INDICATION
WH	ELEC. ENERGY CONSUMPTION
TC	TEMPERATURE CONTROLLER
LC	LEVEL CONTROLLER
TS	TEMPERATURE SENSOR

PROJECT: ND22
BUILDING NAME: CONSOLIDATED DORMITORY
BUILDING NO: 717
MECHANICAL ROOM NO: 001
SYSTEM: MISCELLANEOUS
OCCUPIED HOURS: 16:00-08:00
SYSTEM/POINT DESCRIPTION

| | | | HARDWARE | | | | | | | | | | | | | | | | | | | | | | SOFTWARE | | | | | | | | | | | | | | | | | | |



HOT WATER SYSTEM SCHEMATIC

NO SCALE

HEATING SYSTEM SEQUENCE OF OPERATION

HEATING MODE-
WHEN ANY UNIT CALLS FOR HEATING (ANY HEATING COIL VALVE OPEN INCLUDING VAV BOXES, UNIT HEATERS), 1
AND THE OUTSIDE AIR TEMPERATURE IS BELOW 68 DEGREES F (ADJ) THE DDC SYSTEM SHALL PLACE THE SYSTEM IN HEATING MODE.

THE HEATING MODE SHALL ACTIVATE THE BOILER(S), BOILER LOOP PUMP(S), AND HEATING WATER PUMP (HWP-1,2) AS DESCRIBED BELOW. WHEN THE OUTDOOR AIR TEMPERATURE RISES ABOVE 70 DEGREES F, THE HEATING SYSTEM SHALL BE OFF.

PRIMARY/BACKUP PUMP CONTROL (HWP-1 & 2)-
WHEN IN HEATING MODE THE PRIMARY PUMP SHALL START AND RUN CONTINUOUSLY. OTHERWISE, BOTH PUMPS SHALL BE OFF.

THE PRIMARY PUMP SHALL OPERATE UNDER NORMAL CONDITIONS. IF THE PRIMARY PUMP FAILS, THE BACKUP PUMP SHALL START. A 30 SECOND DELAY SHALL BE PROVIDED BETWEEN STOP AND START OF PUMPS. THE DDC SYSTEM SHALL TIME-STAMP AND STORE EACH SWITCHOVER.

BOILER LOOP CIRCULATION PUMP CONTROL-
WHEN IN HEATING MODE THE BOILER LOOP CIRCULATION PUMP(S) SHALL BE STARTED / STOPPED BY THE ASSOCIATED BOILERS FACTORY INSTALLED CONTROL SYSTEM, BASED ON THE BOILER MANUFACTURERS WATER FLOW REQUIREMENTS, WHEN THE PUMP'S ASSOCIATED BOILER IS ACTIVATED.

TO PROVE FLOW, THE DDC SYSTEM SHALL MONITOR A CURRENT SWITCH ON THE POWER SUPPLY TO EACH BIULDING HEATING WATER PUMP.

BOILER CONTROL (B-1 THROUGH B-2)-

THE DDC SYSTEM SHALL CONTROL THE OPERATION OF THE BOILERS THROUGH THE PLANT MASTER CONTROLLER PROVIDED BY THE BOILER MANUFACTURER. WITH THE OUTSIDE AIR TEMPERATURE BELOW 75 DEGREES F (ADJ) THE BOILERS SHALL BE ENABLED. THE PLANT MASTER CONTROLLER SHALL OPERATE ONE OR BOTH BOILERS AS REQUIRED TO MAINTAIN THE SUPPLY WATER TEMPERATURE AT THE SETPOINT. THE SETPOINT TEMPERATURE SHALL BE RESET BASED ON THE RESET SCHEDULE. THE PLANT MASTER CONTROLLER SHALL OPERATE THE BOILERS IN A MANNER THAT WILL MEET THE HEATING REQUIREMENT WITH ONE BOILER, TO THE EXTENT POSSIBLE. THE PLANT MASTER CONTROLLER WILL ALTERNATE THE BOILER DESIGNATED AS THE "PRIMARY" BOILER EVERY 168 HOURS (ADJ). EACH BOILERS ASSOCIATED BOILER LOOP PUMP SHALL BE OPERATED BY THE ASSOCIATED BOILERS FACTORY INSTALLED CONTROL SYSTEM,

IN ACCORDANCE WITH PARAGRAPH "BOILER LOOP CIRCULATION PUMP CONTROL".

TRENDING-
REAL TIME TRENDING SHALL BE SET UP FOR PUMP STATUS (HW-PMP-S (rpt)) (INCL. BOILER PUMPS), PUMP START/STOP (HW-PMP-SS (rpt)) (INCL. BOILER PUMPS), SYSTEM TEMPERATURES (HWS-T (rpt), HWR-T (rpt)), BOILER STATUS (HW-B-S (rpt)), BOILER START/STOP (HW-B-SS (rpt)) (NOTE: THIS IS FOR ALL BOILERS INDIVIDUALLY). HISTORICAL TRENDING SHALL INCLUDE ALL POINTS FOR REAL TIME TRENDING AND OUTSIDE AIR TEMPERATURE (OA-T (rpt)), AND HOT WATER SYSTEM SET POINT TEMPERATURE (HWS-T-SP (rpt)).

US Army Corps of Engineers ®
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

DESIGN BY: KP	ISSUE DATE: 03-23-2015
DRAWN BY: KP	SOLICITATION NO.: W9128F-15-B-0007
CKD BY: MTS	CONTRACT NO.: -
SBMT BY: MTS	PLOT DATE: 4/10/2015 3:40:19 PM
PLOT SCALE: 1:2 = 1'-0"	FILE NUMBER: AK7251-154-1-01
SIZE: 22" x 34"	FILE NAME:

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

BOILER CONTROL

SHEET IDENTIFICATION
M-703

LIGHTING FIXTURE SCHEDULE - CAVALIER DORMITORY							
FIXTURE SYMBOL	Count	LAMPS TYPE	LAMPS WATTS	VOLTS	MOUNTING	DESCRIPTION	REMARKS
AE	4	LED	38 W	120 V	CEILING	2 X 4 RECESSED LED TROFFER	RECESSED TROFFER; 3500K; DIMMABLE; 1400 LUMEN EMERGENCY BATTERY AS INDICATED ON DRAWINGS
B	7	LED	38 W	120 V	CEILING	1X 4 RECESSED LED TROFFER	RECESSED TROFFER; 3500K; DIMMABLE; 1400 LUMEN EMERGENCY BATTERY AS INDICATED ON DRAWINGS
BOLLARD	4		39 W	208 V	EXTERIOR	BOLLARD EXTERIOR LED LIGHT	8" ROUND LED BOLLARD; SYMMETRIC; 3000K; 1000 LUMENS; PHOTOCELL; DIMMABLE; BRONZE
C	21	LED	20 W	120 V	CEILING	6" RECESSED DOWNLIGHT	6' DOWNLIGHT; SHALLOW CEILING; IC RATED; 1000 NOMINAL LUMENS; 3500K; WHITE BAFFLE
D	4	LED	15 W	120 V	CEILING	PENDANT LIGHT ENTRY	9" CYLINDER PENDANT; MVOLT; DIMMING; 2900 LUMENS; 3500K; PENDANT 3/8 THREAD MOUNT; EMERGENCY BATTERY AS SHOWN ON DRAWINGS
E	4	LED	38 W	120 V	WALL	4' DIRECT/INDIRECT WALL	4' DIRECT/INDIRECT; WALL MOUNTED LED; UP AND DOWN; 3500K; DIMMABLE; WHITE; WITH EMERGENCY BATTERY AS SHOWN ON DRAWINGS
F	8	LED	19 W	120 V	CEILING	4" RECESSED DOWNLIGHT	RECESSED 1000 LUMEN; 3500K; DIMMABLE; IC HOUSING; DOWNLIGHT; EMERGENCY BATTERY AS SHOWN ON DRAWINGS
G	10	LED	9 W	120 V	WALL	3' LED BATHROOM LIGHT	3' LED; 500 LUMENS; 3500K DIMMABLE; UNIIVERSAL VOLTAGE; WHITE
H	9	LED	5 W	120 V	UNDERCABINET	1' UNDERCABINET LED	1' UNDERCABINET; 300 LUMENS; 3000K; DIMMABLE; INTERNAL JUNCTION BOX; BLACK TRIM;
I	16	A-TYPE LED	11 W	120 V	CEILING	CEILING FAN	CEILING FAN; WHITE;
J	4	LED	50 W	120 V	WALL	LED SITE LIGHT	WALL MOUNT SITE FIXTURE; FULL CUTOFF; 5000K; DIMMABLE; FIELD INSTALLED PHOTOCONTROL; BRONZE;
K	8	LED	20 W	120 V	CEILING	6" RECESSED DOWNLIGHT	6' DOWNLIGHT; SHALLOW CEILING; IC RATED; 1400 NOMINAL LUMENS; 3500K; LENSED SHOWER, WET RATED
L	3	LED	10 W	120 V	CHAIN	LED INDUSTRIAL STRIP LIGHT	8' INDUSTRIAL STRIP LIGHT; WITH REFLECTOR; 4500 LUMENS OUTPUT; WHITE REFLECTOR; EMERGENCY BATTERY; DIMMABLE; 36" CHAIN
XC1	3	LED		120 V	CEILING	CEILING-MOUNTED EXIT SIGN	SINGLE-SIDED; RED STENCIL LETTERS; EMERGENCY BATTERY POWER; SELF-DIAGNOSTICS.
XC2	1	LED		120 V	CEILING	CEILING-MOUNTED EXIT SIGN	DOUBLE-SIDED; RED STENCIL LETTERS; EMERGENCY BATTERY POWER; SELF-DIAGNOSTICS.
XW1	1	LED		120 V	WALL	WALL-MOUNTED EXIT SIGN	PARALLEL TO WALL; SINGLE-SIDED; RED STENCIL LETTERS; EMERGENCY BATTERY POWER; SELF-DIAGNOSTICS.

NOTES:

1. EMERGENCY FIXTURES ARE DESIGNATED WITH A LETTER "E" AFTER THE FIXTURE SYMBOL. FIXTURE SHALL MEET NFPA REQUIREMENTS FOR EMERGENCY EGRESS LIGHTING.
2. CEILING FAN SHALL BE INSTALLED WITH LED TYPE "A" LAMP.
3. DAYLIGHTING AND OCCUPANCY SENSORS SHALL BE CONNECTED TO FIRE ALARM CONTACT(S) FOR FIRE ALARM OVERIDE OF ALL OCCUPANCY, LIGHT DIMMING, ETC.
4. DAYLIGHT SENSOR SHALL DIM LIGHTS IN COMMUNITY ROOM ONLY.
5. LIGHTING CONTROL PANEL SHALL CONNECT TO BUILDING MANAGEMENT SYSTEM WITH A RS485 OR APPLICABLE COMMUNICATIONS PORT FOR FUTURE BUILDING MANAGEMENT SYSTEM. SEE MANUFACTURERS REQUIREMENTS.

1

US Army Corps of Engineers ®
OMAHA DISTRICT

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US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

DESIGN BY: PFW
DRAWN BY: PFW
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CKD BY: SLO
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CONTRACT NO.: -
FILE NUMBER: FAT#13-04-01
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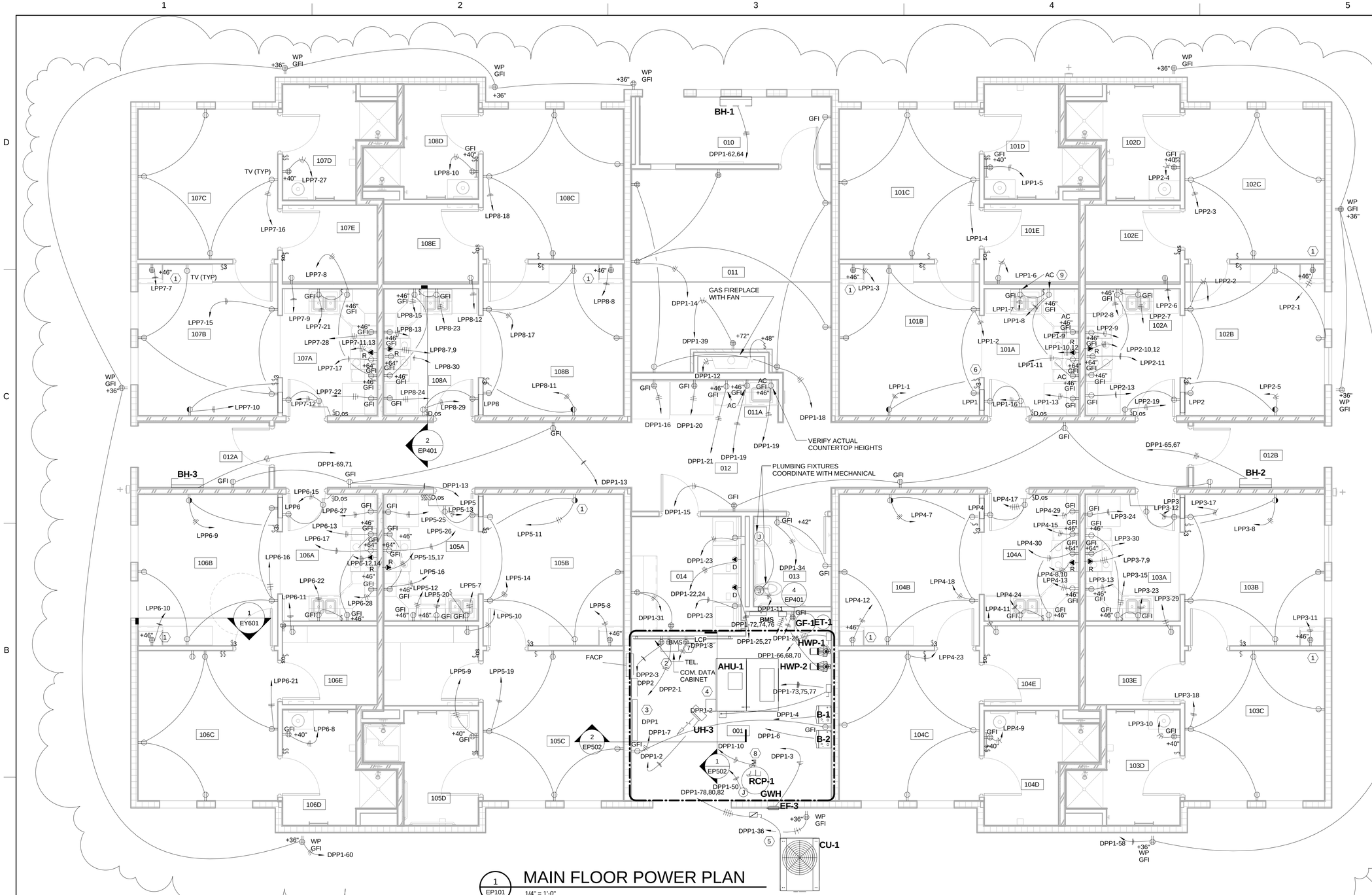
FILE NAME: N:\02\2-DORM-CVLR.RVT

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

LIGHT FIXTURE SCHEDULE

SHEET IDENTIFICATION
EL601


BH-1
BH-2
BH-3
AHU-1
UH-3
HWP-1
HWP-2
B-1
B-2
GF-1
ET-1
RCP-1
GWH
EF-3
CU-1
BMS
LCP
TEL.
COM. DATA CABINET
FACP
GAS FIREPLACE WITH FAN
VERIFY ACTUAL COUNTERTOP HEIGHTS
PLUMBING FIXTURES COORDINATE WITH MECHANICAL
107C
107D
107E
107B
107A
108D
108C
108E
108B
108A
106B
106A
106E
106C
106D
105A
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010
011
011A
012
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014
001
WP GFI +36"
GFI
TV (TYP)
LPP7-7
LPP7-15
LPP7-16
LPP7-8
LPP7-9
LPP7-21
LPP7-28
LPP7-11,13
LPP7-17
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LPP8
LPP8-11
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LPP1-10,12
LPP1-11
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LPP1
LPP1-16
LPP1-13
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LPP2-3
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LPP2-6
LPP2-7
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LPP6-15
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LPP6-13
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LPP6-22
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LPP3-18
LPP3-10
LPP3-11
DPP1-62,64
DPP1-14
DPP1-39
DPP1-12
DPP1-16
DPP1-20
DPP1-21
DPP1-19
DPP1-18
DPP1-69,71
DPP1-13
DPP1-15
DPP1-23
DPP1-34
DPP1-22,24
DPP1-31
DPP1-11
DPP1-72,74,76
DPP1-25,27
DPP1-26
DPP1-66,68,70
DPP1-73,75,77
DPP1-4
DPP1-6
DPP1-10
DPP1-3
DPP1-50
DPP1-78,80,82
DPP1-36
DPP1-60
DPP1-65,67
DPP1-58
DPP2-3
DPP2
DPP2-1
DPP1
DPP1-7
DPP1-2
DPP1-5
DPP1-54
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DPP1-61
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DPP1-75
DPP1-77
DPP1-79
DPP1-81
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DPP1-84
DPP1-82
DPP1-76
DPP1-74
DPP1-70
DPP1-68
DPP1-66

MECHANICAL EQUIPMENT - ELECTRICAL CONNECTION SCHEDULE

E.Q. I.D. TAG	MEC Apparent Power	DESCRIPTION	LOCATION	VOLTS	PH	HP	FLA	MCA	PKG UNIT	NEMA ENCL.	DISCONNECT			STARTER		PANEL	CKT. NUM.	SUPPLY CIRCUIT	Comments
											TYPE	SIZE	FUSE	TYPE	SIZE				
AHU-1	8100 VA	AIR HANDLING UNIT	ROOM 001 MECHANICAL	208 V	3	5 hp	22.5 A	28.0 A	Yes	-	-	60 A	50A	FVNR	1	DPP1	73,75,77	3#6, 1-#6G; 1"C	CIRCUIT TO FUSED DISCONNECT TO DPP1
B-1	252 VA	BOILER	ROOM 001 MECHANICAL	120 V	1	-	2.1 A	-	-	1	-	-	-	-	-	DPP1	4	2#12, 1-#12G; 3/4"C	
B-2	252 VA	BOILER	ROOM 001 MECHANCIAL	120 V	1	-	2.1 A	-	-	1	-	-	-	-	-	DPP1	6	2#12, 1-#12G; 3/4"C	
BH-1	1000 VA	BASEBOARD HEATER	010 VESTIBULE	208 V	1	-	3.6 A	-	-	1	-	-	-	-	-	DPP1	62,64	2#12, 1-#12G; 3/4"C	
BH-2	1000 VA	BASEBOARD HEATER	012B VESTIBULE	208 V	1	-	3.6 A	-	-	1	-	-	-	-	-	DPP1	65,67	2#12, 1-#12G; 3/4"C	
BH-3	1000 VA	BASEBOARD HEATER	012A VESTIBULE	208 V	1	-	3.6 A	-	-	1	-	-	-	-	-	DPP1	69,71	2#12, 1-#12G; 3/4"C	
CU-1	12960 VA	CONDENSING UNIT	BUILDING EXTERIOR	208 V	3	-	34.4 A	36.0 A	-	3	TPST	60 A	45	-	-	DPP1	78,80,82	3#6, 1-#6G; 1"C	CIRCUIT TO FUSED DISCONNECT
EF-1	6 VA	BATHROOM EXHAUST	107D BATHROOM	120 V	1	-	0.2 A	-	-	-	-	-	-	-	-	LPP7	1	2#12, 1-#12G; 3/4"C	NOTE 2
EF-1	6 VA	BATHROOM EXHAUST	105D BATHROOM	120 V	1	-	0.2 A	-	-	-	-	-	-	-	-	LPP6	2	2#12, 1-#12G; 3/4"C	NOTE 2
EF-1	6 VA	BATHROOM EXHAUST	108D BATHROOM	120 V	1	-	0.2 A	-	-	-	-	-	-	-	-	LPP8	1	2#12, 1-#12G; 3/4"C	NOTE 2
EF-1	6 VA	BATHROOM EXHAUST	101D BATHROOM	120 V	1	-	0.2 A	-	-	-	-	-	-	-	-	LPP1	21	2#12, 1-#12G; 3/4"C	NOTE 2
EF-1	6 VA	BATHROOM EXHAUST	102D BATHROOM	120 V	1	-	0.2 A	-	-	-	-	-	-	-	-	LPP2	17	2#12, 1-#12G; 3/4"C	NOTE 2
EF-1	6 VA	BATHROOM EXHAUST	105D BATHROOM	120 V	1	-	0.2 A	-	-	-	-	-	-	-	-	LPP5	1	2#12, 1-#12G; 3/4"C	NOTE 2
EF-1	6 VA	BATHROOM EXHAUST	104D BATHROOM	120 V	1	-	0.2 A	-	-	-	-	-	-	-	-	LPP4	1	2#12, 1-#12G; 3/4"C	NOTE 2
EF-1	6 VA	BATHROOM EXHAUST	103D BATHROOM	120 V	1	-	0.2 A	-	-	-	-	-	-	-	-	LPP3	1	2#12, 1-#12G; 3/4"C	NOTE 2
EF-1	6 VA	BATHROOM EXHAUST	013 BATHROOM	120 V	1	-	0.2 A	-	-	-	-	-	-	-	-	LCP	3	2#12, 1-#12G; 3/4"C	NOTE 3
EF-1	6 VA	BATHROOM EXHAUST	014 LAUNDRY ROOM	120 V	1		0.2 A	-	-	-	-	-	-	-	-	LCP	2	2#12, 1-#12G; 3/4"C	
EF-2	58 VA	EXHAUST FAN PH-1	ATTIC	120 V	1	0.05 hp	0.5 A	-	-	-	-	-	-	-	-	DPP1	5	2#12, 1-#12G; 3/4"C	EXHAUST FAN FOR PENTHOUSE IN ATTIC
EF-3	1600 VA	EXHAUST FAN	ROOM 001 MECHANICAL	120 V	1	0.75 hp	13.8 A	-	-	-	-	-	-	-	-	DPP1	3	2#12, 1-#12G; 3/4"C	EXHAUST FAN IN MECH ROOM
ET-1	-	EXPANSION TANK	ROOM 001 MECHANICAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NO ELECTRICAL LOAD
GAS METER	-	GAS METER	BUILDING EXTERIOR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NO ELECTRICAL LOAD
GF-1	180VA	GLYCOL FEEDER	ROOM 001 MECHANCIAL	-	-	-	-	-	-	-	-	-	-	-	-		-	-	RECEPTACLE LOAD ONLY
GWH	-	GAS HOT WATER HEATER	ROOM 001 MECHANICAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120V SINGLE PHASE CIRCUIT, SEE EP101
HWP-1	1260 VA	HOT WATER PUMP	ROOM 001 MECHANICAL	208 V	3	0.5 hp	3.5 A	-	-	1	TPST		6A	-	-	DPP1	66,68,70	2#12, 1-#12G; 3/4"C	
HWP-2	1260 VA	HOT WATER PUMP	ROOM 001 MECHANICAL	208 V	3	0.75 hp	3.5 A	-	-	1	TPST		6A	-	-	DPP1	72,74,76	2#12, 1-#12G; 3/4"C	
PH-1	728 VA	PENTHOUSE LOUVER	ATTIC	28 V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ELECTRICAL DAMPER POWER
RCP-1	250 VA	RECIRCULATION PUMP	ROOM 001 MECHANICAL	120 V	1	0.01 hp	2.1 A	-	-	3	-	-	-	-	-	DPP1	10	-	
UH-1	696 VA	UNIT HEATER	ATTIC	120 V	1	0.25 hp	5.8 A	-	-	-	-	-	-	-	-	DPP1	9	2#12, 1-#12G; 3/4"C	FAN MOTOR
UH-2	696 VA	UNIT HEATER	ATTIC	120 V	1	0.25 hp	5.8 A	-	-	-	-	-	-	-	-	DPP1	9	2#12, 1-#12G; 3/4"C	FAN MOTOR
UH-3	528 VA	UNIT HEATER	ROOM 001 MECHANICAL	120 V	1	0.16 hp	4.4 A	-	-	-	-	-	-	-	-	DPP1	2	2#12, 1-#12G; 3/4"C	FAN MOTOR

NOTES:

1. MECHANICAL EQUIPMENT WITH CONTROLS ONLY. VERIFY WITH MECHANICAL FOR ANY ELECTRICAL REQUIREMENTS.
2. BATHROOM EXHAUST FANS CIRCUITED WITH SWITCHABLE CIRCUITS.
3. COORDINATE WITH MECHANICAL CONTRACTOR FOR ALL ELECTRICAL REQUIREMENTS.
4. ALL ADDITIONAL MECHANICAL CONTROLS, EITHER 120V OR LOW VOLTAGE THAT REQUIRE AN ELECTRICAL CIRCUIT SHALL BE FED FROM SPARE BREAKERS IN PANEL DPP2.
5. GAS METER AND EXPANSION TANK DO NOT REQUIRE ELECTRICAL CONNECTIONS.

1

ELECTRICAL EP602-

US Army Corps of Engineers ®
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR
1	AMENDMENT 00001 - GENERAL REVISIONS	4-13-2015	

ISSUE DATE: 03-23-2015
SOLICITATION NO.: W9128F-15-B-0007
CONTRACT NO.: .
FILE NUMBER: #4761-34-041
DESIGN BY: PFW
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OMAHA DISTRICT
OMAHA, NEBRASKA

CONSOLIDATED DORMITORY
CAVALIER AFS, ND.

MECHANICAL EQUIPMENT-ELECTRICAL CONNECTIONS SCHEDULE

SHEET IDENTIFICATION
EP602